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WESTERN AUSTRALIA

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Editor:
E. H. LAWSON, M.Sc. (Agric.).

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COVER PICTURE
Bean growing at Carnarvon—see page 478.

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Poisoning Rabbits from the Air

by C. D. GOODING, B.Sc., (Agric.)

Filling the hopper with poisoned carrot bait before take-off (photo from "Airwork")

AERIAL baiting gives spectacular kills of rabbits in country which cannot be effectively treated by conventional means, and has been widely adopted in New Zealand and other States in Australia. Here Mr. Gooding reports on developments in aerial baiting in Victoria, and suggests practical applications in Western Australia.

Aerial poisoning has gained a large following in Australia during the last few years following a successful introduction in New Zealand in June, 1949. At that time the use of aircraft in Agriculture by New Zealand farmers was generally further advanced than in Australia, so it was not surprising that the original development took place in that country.

The interest taken in Aerial Baiting in Australia dates from the time when Mr. B. V. Fennessey of the C.S.I.R.O., Wildlife Survey Section, reported in March, 1957, on a visit to New Zealand. A delegation headed by the Victorian Minister for Lands and including several representatives of farmer organisations and departmental officers interested in rabbit control then visited New Zealand and returned

impressed with this method of controlling rabbits.

Farmers from the Averal and Strath Creek areas of Victoria, in collaboration with the appropriate departmental officers initiated a trial baiting in June, 1959. This was followed by larger trials in July in the Yea district in Victoria. These proved so successful and the pressure for further work was so great that the Victorian Lands Department instituted experimental work to assess such important points as:—

(a) percentage kill
(b) rate, number and spacing of free feeds
(c) weathering of bait material on exposure
(d) economics of aerial baiting . . .
. . . and many others.

Results of these investigations were presented to the last Vermin Control Conference by Mr. B. Woodfield of the Vermin and Noxious Weeds Branch of the Victorian Crown Lands and Surveys Department.

Both in New Zealand and Victoria carrot is the preferred bait material. Apple is sometimes used but because of the carrot's palatibility to the rabbit, its texture (it does not damage on hitting the ground) its resistance to heat, and its general ease of handling, it is generally preferred to other fleshy baits. Oats is not recommended as a bait because it constitutes a greater danger to stock. Where covering up is not possible (as in aerial baiting) carrot is preferred because it slowly deteriorates when exposed to atmospheric conditions (see section on weathering of bait material).

(a) **Percentage kill (carrot):**

At the two main experimental sites kills approaching 100 per cent. were obtained (95 and 99 per cent.). The officers concerned hoped that at this rate it would only be necessary for aerial poisoning of holdings every second or third year.

(b) **Free feeding (carrot):**

It was shown that under most conditions two free feeds were adequate when spaced approximately one week apart. The rate of free feed used was 8 lb. per acre.

(c) **Weathering of bait material (carrot):**

Baits were collected from the treated area at three-day intervals and tested by feeding the rabbits in cages. In one test area the bait became unpalatable after 26 days and in the other area after 19 days. This point is of vital importance since it is not possible to cover each piece of poisoned bait before returning the stock to the area. For this reason it would not be advisable to use a permanent bait medium such as oats.

(d) **Economics of aerial baiting:**

Following the experimental work an agreement was entered into with the Aerial Operators' Association whereby a guaranteed maximum price of 3s. 5d. per acre within 1½ miles of airstrip, ranging up to 4s. 8d. per acre within five miles of strip would be charged. The farmer was to supply poisoned carrot to the pilot who would then load and spread it.

In practice the total cost of the operation works out at between 5s. and 6s. 6d. per acre, including cost of bait.

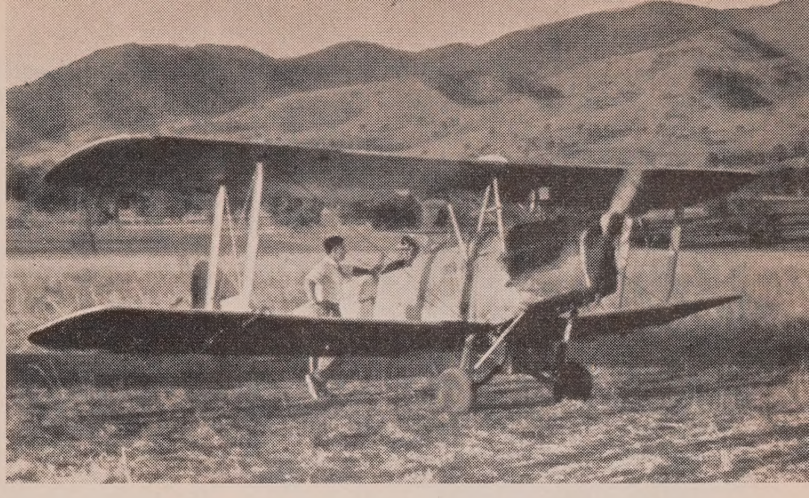
Wherever aerial baiting has been used it has caught the imagination of landholders and vermin control authorities alike.

For example, the following table shows the rapid spread in New Zealand:—

TABLE 1

RABBIT POISONING

	1951	1952	1953	1954	1955	1956
Hours flown	1,015	1,190	1,980	3,501	2,362	3,042
Number of Flights	2,906	4,023	7,298	14,929	11,442	15,242
Quantity distributed (tons)	357	514	1,313	2,787	2,719	4,617



Tiger Moth aircraft ready for take-off at Swifts Creek area. Hills in the background were being treated. Successful conventional baiting would be impossible here

Armed with this information I recently made a quick survey of aerial baiting in Victoria including in my enquiry some of the more practical points which would interest any farmers who may wish to pursue the matter in Western Australia.

AERIAL BAITING IN VICTORIA

By the end of October, 1960, approximately 250,000 acres had been treated by aerial baiting in Victoria. This was made up of:—

105,000 acres treated during 1959.
45,000 acres during 1960 until April.
100,000 acres 1960 April-October.

Total 250,000 acres

At the moment all aerial baiting is being carried out on areas which cannot be handled by orthodox methods and where vehicles cannot travel. It has, however, been suggested that aerial baiting may eventually become widely used as a standard method of rabbit control.

Aerial baiting developments in Victoria can best be summarised under the following headings:—

(a) Airstrips
(b) Aircraft and hoppers
(c) Organisation of work
(d) Aerial Operators' part
(e) Baits used.
(f) Bait cutting and poison mixing
(g) Areas treated
(h) Laying methods and coverage obtained
(i) Kills and fauna damage
(j) Economics

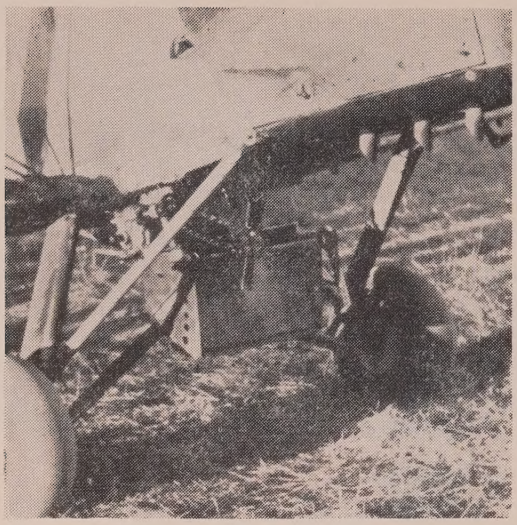
(a) **Airstrips:**

The Department of Civil Aviation has laid down regulations about the size and condition of airstrips to be used in this type of operation. These can be summarised as follows:—A strip of land 400 yards x 50 yards over which a car can be driven at 30 m.p.h. is satisfactory for light aircraft such as Moths.

The pilots doing this work can, and often do, use strips much shorter than this. Pilots prefer a strip running up and down an incline, as with such a strip it is possible to use a shorter length of runway. An airstrip adjacent to water for washing up at the end of mixing is an advantage but not essential. The problem of the intense wind erosion caused by the aircraft when it commences its take-off run must be considered, especially as the effect is to leave a bare patch of soil which may form a nucleus for future water erosion.

(b) Aircraft and hoppers:

The most favoured aircraft for aerial rabbit poisoning in Victoria is the Tiger Moth. It is preferred by most pilots because of its reliability and manoeuvreability. Others which have been used are Avro Cadets, Austers, Pipers, Cessnas and Percival E.P.9's. The hourly charges for each type have been calculated bearing in mind payload, running costs, etc., and vary from £20 an hour for a Moth up to £35 an hour for an E.P.9. The standard area treated by a Moth with average dead



Close-up of specially designed chute to release and disperse carrot bait

flying is 400 acres an hour. This may be increased or decreased by:—

(1) Amount of dead flying to and from airstrip.

(2) Ability of bait cutting and mixing staff to maintain a supply of bait.

(3) Methods of loading, hopper construction, flying height, and so on.

The same aircraft hoppers are generally used for aerial baiting as for super spreading, with minor modifications. It was found that bait became wedged in the hopper opening and prevented a free flow. Originally the pilot overcame this by constantly wiggling the release shutter, but this proved unsatisfactory and a propellor was attached to the hopper housing. Driven by the passage of the aircraft through the air this actuates a joggle mechanism inside the hopper, so preventing cavitating and sticking of the bait.

(c) **Organisation of work:**

The work is organised by a Lands Department Inspector, who visits each farm and arranges for the land to be made available for aerial baiting. If possible, he arranges for all farmers with a specific problem to be treated in one block. The maximum area which can conveniently be handled by a Moth in one block is 9,000 acres, and the minimum to ensure an economical cost to the farmer is 3,000. (At present some smaller areas are being treated, mainly for their publicity value.)

Having once organised the group the Inspector hands over to the aerial operator whose responsibility it becomes to arrange a satisfactory date.

The inspector arranges to have the necessary supply of carrots on hand and personally mixes all bait. This is as far as his duties extend except to maintain a watching brief, and, if he is dissatisfied with the result, to call in the operator and request that the job be repeated at no cost to the farmer.

(d) **Operators' responsibilities:**

Having taken charge of the group and arranged for the inspector to supply bait and poison, the operator arranges a suitable commencing date and starts work. It is his responsibility to cut and load all free feed, to cut bait for impregnation and to clean up the site at the end of the operation. For small groups it is customary for an operator to employ a 3-man team—pilot, bait-cutter and loader. The choice of suitable aircraft, landing strip, and so on is the responsibility of the operator. Contracts are signed between the operator and the landholders.

At a combined meeting of the aerial contractors and the Lands Department Officers the State was zoned to avoid overlapping of services. This was a voluntary arrangement to stablise the price charged, and to set a standard for the service given. (For details see report in "Vermin Control Conference 1960" by B. Woodfield.)

(e) **Baits used:**

At present carrots are used exclusively. All bait used is grown under gentleman's agreement between the Lands Department and growers in selected parts of the State. The grower is guaranteed a price of £12 a ton on the farm. It is the inspector's responsibility to organise supplies of carrot bait.

(f) **Bait cutting and poison mixing:**

When carrots are delivered on the job the operator sets about preparing them for distribution. First they must be

washed, as they are mostly grown in heavy soil country. There are several types of machine used to cut the carrots into suitably sized pieces. One operator has imported a machine developed in New Zealand which cuts the carrots and impregnates them with poison in one operation. This machine which cuts a relatively small uniform bait, is quick and ideally suited to aerial work.

Most of the smaller contractors hire cutters from the Lands Department. These are relatively cheap, simple machines powered by 1 or 2 h.p. petrol engines. These cut about a bag of carrots a minute.

The size or shape of the bait seems to have little bearing on the results achieved. It is reported that the smaller baits are usually eaten first.

Poison mixing under this system is carried out in a motorised cement mixer, the poison being sprinkled in from a shaker. Poison mixing is always the bottleneck in the process, and it is intended to speed up this section of the work by the use of a pressure spray device.

(g) **Areas treated:**

Some of the areas treated successfully from the air deserve description, so that they may be compared with similar areas which may be considered for treatment in Western Australia.

Derinillan district:

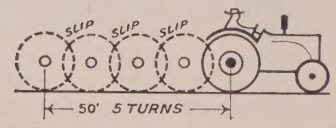
Situated in some of the best sheep country in the Western Districts, this area is one of the last strongholds of commercial trapping in Victoria. Trappers concentrate on what is called the "stony rise country." Western Victoria possesses some relatively recent volcanoes and some still discernible lava flows. These lava flows, up to 20 or 30 ft. high, are now in the process of weathering and in so doing have produced low boulder-strewn ridges. The stones range in size up to two or three feet in diameter and are so thick that no vehicle can traverse these areas, which may be half a mile wide and up to 30 miles long. Frequently the ridges are separated by narrow valleys, usually about 100 yards wide. There is ample feed among the stones to provide a good medium for rabbit reproduction, and the

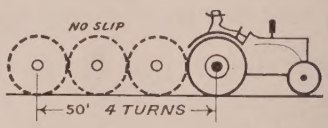
Omeo, in the foothills of the Southern Alps. This is typical of the country now being treated from the air.

You can't beat 'slip' completely . . .

WHEEL SLIP IN TRACTOR OPERATION

Everyone knows what wheel "spin" is—for example, when the rear wheels of a motor car spin around on mud or some other slippery surface so that the car remains at a standstill. Wheel "slip" is the same sort of thing in a less acute form. The car or tractor does not come to a complete standstill, but it travels forward a much shorter distance than it should for each revolution of its driving wheels. In such a case the wheels may be turning five times in order to move the tractor 50 feet along the ground when, if there were no wheel slip, four times would do.





WHEEL SLIP THEREFORE LEADS TO . . .

1. Waste of fuel. 2. Loss of power at the drawbar. 3. Excessive wear on tyres.

WHEEL 'SLIP' IS NOT ALWAYS OBVIOUS

Up to twenty per cent. wheel "slip" is not easily seen and many farmers think that wheel "slip" occurs suddenly. They regard wheel "slip" as unimportant until they can actually see it. This is far from the case. That twenty per cent. "slip" must be translated into fuel loss, work loss and horse-power loss from your tractor.

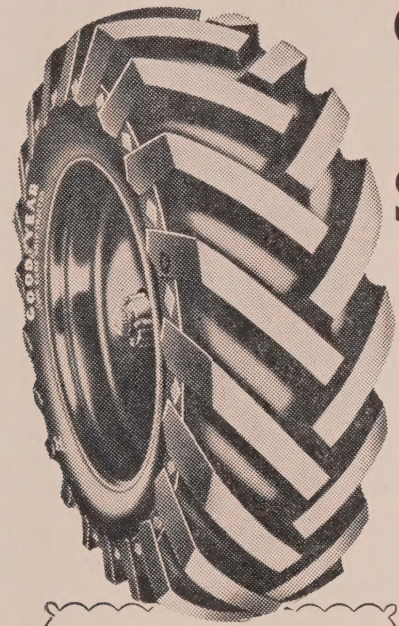
Effect of Modern Implements on Tractor Tyre Efficiency

Modern farm implements are increasing in size and efficiency, with the result that additional strain is placed on tractors and tractor tyres in their hauling operations.

Even where free-rolling conditions are perfect, "drag" by these heavier implements absorbs a certain amount of horsepower. This "drag" also places an additional impost on tractor tyres and, where treads are worn, creates excessive wear through slip when starting.

Now with exclusive 3T RAYON.

but you can minimise it with



GOODYEAR

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LESS SLIP...

WEDGE-IN GRIP. Lugs are set closer at tyre shoulder than at centre. They wedge the soil between them to give the greatest pull on earth.

SELF-CLEANING OPEN CENTRE treads have no mud-trapping pockets. Lugs rise from ground leaving wedge-grip printed in the soil. They are clean for the next time around.

TOUGHER LUGS ARE STRAIGHT AS A RULER. Every square inch of pushing surface takes an active part in driving against a solid wall of soil.

REGULAR SPACING AND BALANCED DESIGN maintain momentum without jerking — give smooth ride even on surfaced roads.

THERE'S A TRIPLE BONUS

with GOODYEAR 3-T SUPER SURE-GRIP TRACTOR TYRES

BONUS 1. **EXTRA TRACTION.** The tread is wider, deeper. With the longer, straight lugs and reinforced base, the Super Sure-Grip has a far more powerful grip in soil—gives positive traction. There's more traction bite and **go** in every wheel turn.

BONUS 2. **EXTRA STRENGTH.** Goodyear's exclusive 3-T process triple tempers strong rayon tyre cord to make it triple tough; gives it tremendous resistance to impact breaks and bruises, keeps Super Sure-Grip strongly rugged all through.

BONUS 3. **EXTRA WEAR.** Super Sure-Grip has modern, stronger, longer wearing rubber compounds in both the tread and sidewalls. This flex-resisting, age-resisting and abrasion-resisting rubber assures extra long wear in all farming.

. . GOODYEAR SUPER SURE-GRIP

L131G

cover provided is perfect. (An interesting fact is that this land is regarded as some of the best in a very rich district. This is probably because the soil is volcanic in origin and comparatively very young.)

The only way of traversing this type of country is on foot or horseback. Drawing a furrow is impossible.

One of the properties being treated (owner, Mr. Austin—a descendant of Thomas Austin of Barwon Park, who introduced the rabbit to Australia 100 years ago) containing a lot of this stony rise country was used extensively for trapping and in two years, 132,000 rabbits were taken from the 6,000 acre property.

Swifts Creek:

Swifts Creek is a small but relatively rich area of farmland situated on the southern edge of the Australian Alps. The area is predominantly used for grazing and from Swifts Creek and Omeo (slightly higher up the Alps) come many of the store cattle fattened in Gippsland before marketing. Farm sizes at Swifts Creek vary from 300 to several thousand acres. The smaller properties have river flats along the Mitta Mitta and produce good quality lucerne hay and other crops. The hilly country is used exclusively for grazing. Land values vary from £15 to £30 an acre on the hills, where 1½ sheep an acre are carried. The stocking is approximately 50 per cent. cattle and 50 per cent. sheep. The green feed period here is almost continuous.

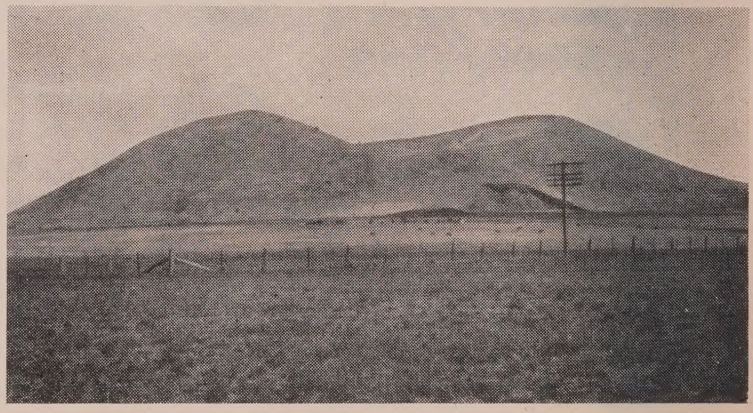
Rabbit control measures used at present are myxomatosis (which seems to be exerting some annual controlling influence) and trail baiting on the hill slopes where a furrow can be drawn. Much of the country being aerial baited is similar to the Blackwood Valley near Nannup. Steep hills, some fallen timber, some part cleared country, all make for difficult rabbit control unless aerial baiting is practiced.

Longford Pine Plantation:

Here 8,600 acres of pine plantation were treated along the firebreaks for a cost of 10d. per acre. Reasons for treatment were:

(1) Rabbits attacking pines
(2) Rabbits reinfesting neighbouring properties
(3) Wallabies ring-barking pines.

This area is very similar to some of the light land being planted with pines in the south-west coastal country of Western Australia. The company which owns this plantation now has 60,000 to 70,000 acres under pines in the Gippsland area, and in future will clear all new land of rabbits by aerial baiting before planting. (See possible application in W.A.).



Mt. Elephant, an extinct volcano in the Western Districts of Victoria. This area was ideal for experimental baiting which gave 100 per cent. kill

Mt. Elephant area:

Green grass is now growing over the Mt. Elephant experimental area, once so eaten out by rabbits that pasture growth was almost prevented. Local farmers agreed that the kill obtained in the initial experiment was 100 per cent. Some six months after treatment there was still no sign of rabbits on the Mount. (The hill itself is fenced off from adjoining farms). There has, in the past, been considerable

water erosion on the slopes, and it will be interesting to see whether this continues now that rabbits have been controlled.

(h) **Laying methods and coverage obtained:**

The Lands Department has laid down minimum quantities of free feed and poison to be laid. These are respectively 5 lb., 6 lb. and 7 lb. of carrots per acre. Baits average 200 to the pound, so these rates are equivalent to about one poison bait to every $3\frac{1}{2}$ square yards (or including free feeding, about one bait a square yard.)

Bait is generally cut on the back of a truck and falls into a cement mixer for impregnation. The cement mixer is placed over a tarpaulin which must be removed, washed and the washings buried before the operator leaves the site. Bait is loaded into the plane by either a front-end loader attached to a truck (as is used in loading superphosphate) or by bags from the tray of the truck.

The aircraft flies at 100 to 200 ft. and at this height it is claimed that a full coverage can be obtained with little if any overlap and practically no blank strips.

One of the advantages of aerial baiting over ground baiting with a trail is the increased percentage kill (see next section). This is due mainly to the fact that the whole of the rabbits' normal feeding area is "saturated" with bait. The problems associated with one rabbit keeping another from the furrow, or a section of the furrow being cleaned out before the late-comers have arrived and bad placement of furrow in relation to feeding grounds are all overcome by "taking bait to every square yard" and to every feeding area.

(i) **Kills obtained:**

So good are the results usually obtained that the authorities consider that if the kill obtained does not approximate 95 per cent. the work can be considered as a failure. A good figure from conventional baiting would be 90 per cent. When assessing a "kill" the important rabbits are not those killed, but those which remain to breed replacements. Thus a 90 per cent. kill (10 left per 100) is only half as good as a 95 per cent. kill (five left), whilst a 99 per cent. kill (one left per 100) is five times as good as a 95 per cent. kill.

The two experimental site kills have been estimated at 99 and 100 per cent. whilst the previous year's experiments yielded 95 to 100 per cent. kills. The Derinillan baiting is also reported to have been an overwhelming success.

The effect of aerial baiting on native fauna has not been severe, except at Longford, where the baiting was designed partially to poison wallabies. The Fish and Game Department in Victoria is pleased with the results and although watching trials with interest has apparently found no cause for alarm.

(j) **Economics:**

It seems that aerial baiting is only economically sound because of the high kills obtained. If the level of kill were to be reduced for 95 to 80 per cent. there would be a residual population four times as large, and aerial baiting would be required every year. Farmers with whom this work was discussed were of the opinion that if treatment were required every year it would not be economically sound. An important factor in increasing the efficiency of the kill is that generally a whole block of country is treated simultaneously resulting in a partial "killer" scheme. Also, comparing the value and productivity of the land being treated with land in W.A. it is clear that the land itself is usually a more highly valued asset than it is in this State. Consequently, farmers are prepared to outlay more money to protect their asset, especially when they can see their money coming back in increased returns in a relatively short period.

Most of the aerial work carried out to date has been in solid farming areas established for some time, where the landholders are financially secure. It would be interesting to see if the reaction of the landholders in the poorer areas is as favourable as those in the wealthier districts.

POSSIBLE APPLICATIONS IN WESTERN AUSTRALIA

There are numerous localities in W.A. where aerial baiting could be used to advantage. These include such places as the Darling Scarp, coastal country, inaccessible swamps, lake margins and steep, hilly and part cleared country along the

Blackwood River. However, in all of these areas the economics of the operation would need close scrutiny before work was commenced. Of the places listed, the Darling Scarp, coastal country and Blackwood Valley would not warrant further consideration (economically) as the areas are only partially developed and the costs of the operation could not be recouped easily from the land. However, the lake margins and swamps could be a different proposition if they were surrounded by high yielding land, which was constantly being infested from such trouble spots.

One other possible application deserves serious consideration. The Forestry Department plants several hundred acres of pines each year. Before planting the Department employs A.P.B. units to poison, then follows up with a second poisoning, fumigation, warren destruction, trapping and dogging all within a temporary netting fence. The costs of complete rabbit clearance by orthodox methods before planting in Victoria vary from 10s. to 15s. per acre. If the costs of manual clearance here are roughly comparable aerial poisoning could almost certainly be carried out more cheaply, and leave forestry workers free to engage in other work. The major problems would be the small size of the area to be treated (500 acres) and locating suitable landing strips. It may even prove practical for the Forestry Department to clear a permanent strip near the centre of its operations for use in the years ahead. (This would also serve as a firebreak.)

FUTURE RESEARCH

In Victoria it is proposed to try different base baits and to attempt poisoning with only one free feed. Results of previous work indicate that this may be effective. No research work on aerial baiting is planned for Western Australia at present, and Victorian work is being closely followed.

ACKNOWLEDGMENTS

The author is indebted to Mr. Geoff. Douglas and Mr. Bruce Woodfield of the Vermin and Noxious Weeds Branch of the Victorian Department of Crown Lands and Surveys for much valuable assistance and for giving him the opportunity of seeing this work at first hand.

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COVER PICTURE — Beans at Carnarvon

Our cover picture shows a good crop of beans growing on each side of a cement watering channel on a Carnarvon plantation. Water—pumped from the river bed—flows from the cement channel to unlined subsidiary irrigation furrows.

Beans are the main vegetable crop at Carnarvon, and the district is well-known for its good crops of exceptional quality. The beans are exported to the Eastern States as well as being trucked to the Perth market.

As Carnarvon beans can be sold "out of season," they usually bring good prices.

Not for the first time beans are helping Carnarvon growers through a difficult period. Bananas are still recovering from the 1960 cyclone, and heavy recent flood damage to some plantations, and quick cash returns from the beans are more than usually welcome.

Some early bean crops can be harvested within eight weeks of planting.

Virtually the only variety grown at Carnarvon is Westralia, now famous for its rust and mosaic resistance. Without this variety, beans could not be successfully produced at Carnarvon.

The Westralia bean was developed by the Department of Agriculture's Plant Pathology Branch. It has since been grown successfully overseas, and used in breeding for rust resistance in the Eastern States of Australia.

Seasonal Notes

ON THE DAIRY FARM

Contributed by OFFICERS OF THE DAIRY DIVISION

Cleansers for the Milking Machine

WITH the opening of the flush season dairy farmers should make sure milking machines are working at maximum efficiency. Machines not working efficiently can cause production losses and damage to cows as well as wasting farmers' time.

One important aspect of machine efficiency which is often overlooked is the use of the correct cleanser for the farm's particular water supply. Compatibility between cleanser and water supply is of paramount importance in determining the efficiency of the cleanser.

Where the quality of the cleansing water is doubtful it may be worth providing a rain water supply, to be retained for machine and utensil cleansing. It is better to spend money on providing such a supply (installing it is the first and last expense) than to invest in a treatment plant to soften the hard water used in the shed.

The quantity of rainwater which must be stored is not great. An allowance of 2½ gallons a head a day would be sufficient. This would be equivalent to 75 gallons a day for a 30-cow herd, and storage would have to be great enough to last through the four summer months. This means that a total storage of 5,000 to 7,500 gallons would be plenty for a herd of this size.

A good cleanser removes fat from the surface of rubber and utensils, and retards the formation of milkstone and mineral stone. It should be cheap and fairly simple, and it must be effective.

The cleanser is usually a mixture of a variety of substances arranged to give the desired properties for the water used. It must be alkaline, to help remove fat and casein deposits, and should contain a wetting agent to enable it to penetrate all parts of the equipment, particularly any fine cracks. A detergent action emulsifies the fat, and helps remove all types of dirt. Slight frothiness improves the scrubbing action and helps carry away dirt from the milk lines, but excess froth makes rinsing difficult. Good rinsing ability is important to ensure that metal surfaces are left in the ideal clean and shiny state.

Besides having all these properties the cleanser should be non-corrosive, so that damage to tinned surfaces, and to the skin of the dairyman, is avoided.

These requirements are not easy to fulfil satisfactorily, particularly when the quality of the water used varies from farm to farm.

It is hard to tell whether the cleanser is working properly, and sometimes ineffectiveness of the cleanser only shows up in results over a few months, for example, through the accumulation of milkstone. If there is any doubt about the efficiency of the cleanser you are using, contact your district officer.

Commercial cleansers are on the market to suit some difficult supplies, and until it becomes possible to recommend particular cleansers for specific troublesome water supplies, it may be worth testing one or more of those available in your shed. Unfortunately, this is still a matter of trial and error.

Catch Mastitis Early To Avoid Losses

MASTITIS is an ever-present menace to production, and should be watched for at all times. But it is particularly important to recognise its incidence at an early stage in lactation if a big production loss is to be avoided.

In the milking shed one of the oldest and simplest yet, paradoxically, least used aids to detection of mastitis is the strip cup. Every dairyfarmer should make a practice of using the strip cup on each cow at each milking, regardless of whether mastitis is suspected or not.

The best weapon against mastitis is still prevention by rearing replacements on the farm rather than purchasing them. This is much sounder than resorting to antibiotic therapy.

If it does become necessary to use antibiotics extreme care must be exercised in their administration to ensure that only the correct dosage is given and to keep the antibiotics out of the milk supply. Serious problems affecting quality have arisen in dairy industries throughout the world because of residual antibiotic in milk sent to treatment plants. In many places strict regulations are in force to prevent the supply of milk containing traces of antibiotics.

Once a cow has been treated with antibiotics she should not be milked for supply to the treatment plant until 72 hours after the last administration.

Having Trouble With Your Calves?

NOW is the time to put the spotlight on your calf feeding practices.

Have you lost any calves so far? Have you some now that are scouring badly, developing pot-bellies, looking listless, developing a rough coat? If so, then somewhere along the line your calf rearing practises are probably at fault, and it may pay dividends to take a critical look at each stage and make any necessary changes. If you save one calf it will more han pay for the effort expended.

To start from the beginning:

Were your cows in the months prior to calving on an adequate diet, sufficient in all respects to produce a healthy calf, and at the same time stand a full lactation?

Did you make sure that the newborn calf received the colostrum for at least the first six days of life? Was the eventual change to skim or milk substitutes a gradual one?

At any stage was there any over-feeding, resulting in a digestive upset?

What about feeding premises and feeding utensils, would they stand a good scrutiny? Are all calves in one paddock constantly so that droppings continually foul the pasture? Is there any chance of arranging some form of paddock rotation for them?

Housing—or some form of protection during winter months: Is it of the fixed variety that quickly gets fouled-up, or is it able to be towed to a new site every few days?

Are tails flicking constantly, is there much licking and scratching? A closer inspection may reveal the presence of that common parasite—the louse, another enemy to health.

Finally, have you heard any persistent and troublesome coughs lately among the calves? If so, the chances are that there's a worm or two around somewhere, especially if you haven't been able to practice the rotation just mentioned.

If then, on checking through, you find a weakness somewhere in your methods, do not hesitate to seek the advice of the local Field Officer, or write for bulletins on the subject: scours and probable mortality can be avoided.

Keep Your Pigs Warm This Winter

ALTHOUGH pigs are largely a sideline to the major dairying enterprises, they can be a profitable sideline if reasonably well kept.

Pig raisers are not always fully aware of the adverse effects that cold and wet winter conditions have on their stock, in particular young pigs farrowed in the early winter months in time to ultilise surplus skim milk.

It is not uncommon to see pigs housed in poorly constructed shelters with only bare earth floors, and sides and roof which permit the entrance of draughts and moisture. Over a period of six to seven months when the cold weather does not allow the surroundings to warm up to any large extent the poorly housed pig suffers the discomforts of these conditions and is unable to utilise its food to the full for the required purpose—to put on weight at a steady and even rate. Much of the food taken in is needed to maintain the body functions at a high level to combat the effects of the cold and wet conditions, and less is available to go into maintaining the growth rate at a satisfactory level.

Under such conditions of discomfort, pigs also become more susceptible to disease. Virus pneumonia resistance in particular is appreciably lowered when pigs are housed under cold and wet conditions, and this disease in itself lowers growth efficiency by about 15 per cent.

Young pigs in their first week or two of life are, of course, the most susceptible to cold, and chilling acccounts for a high proportion of deaths at this stage.

The sideline pig house need not be elaborate, but should be reasonably well constructed. It should have good concrete floors to stop moisture coming up from below, and walls of close weatherboard or other material which will keep the draught and moisture out. The roof must be rainproof. The house should be designed so that there is some air circulation, and moisture does not condense on the inside of the roof.

Best site for the house is on a sloping area so that there is good drainage away from it, and moisture does not collect nearby.

Radiant heaters in the house are a good investment for keeping piglets warm in the critical early days of their life.

In fairness to your pigs, give some thought to keeping them free from the hazards of a cold, wet winter. Extra efforts made to provide comfort and warmth will be repaid handsomely through increased feed efficiency and growth rate, and may get the pigs away to market just that little bit earlier.

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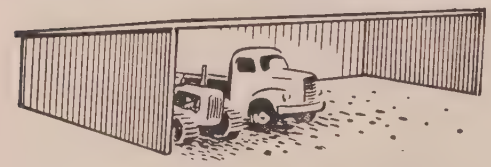

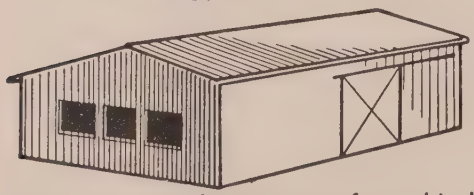

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SPRAY THINNING OF JAPANESE PLUMS

By J. CRIPPS, B.A., B.Sc. (Hort)., Research Officer, Plant Research Division

THE hand thinning of Japanese plums is the most tedious work which the orchardist is called upon to undertake so that any method of crop reduction other than by hand should be welcome. Growers may, therefore, be pleased to know that in experiments conducted by the Department of Agriculture several varieties have been successfully spray thinned. The material used was D.N.B.P. (Dinitro secondary butyl phenol) at ½ to ¾ pint to 100 gallons of water and the varieties concerned were Wickson, Wilson, Satsuma and Delaware. Spraying with this material considerably reduces but does not eliminate hand thinning.

ADVANTAGES OF SPRAY THINNING

Crop reduction by spray thinning, in addition to reducing tedium, has certain economic advantages. These are:

1. A decrease in the man hours necessary to carry out hand thinning, a factor which is increasing in importance with rising labour costs.

2. An increase in fruit size, which leads to an increase in the proportion of fruit exportable and to a decrease in handling and packing costs.

3. More regular cropping and less biennial bearing.

4. An increase in foliage both due to larger leaves and more shoot growth, which gives rise to greater protection of the fruit from sunburn.

5. If spray thinning is practised there is less need to thin by hard winter pruning which reduces leaf surface and eventual tree size.

6. The recommended spray material (D.N.B.P.) is cheap, and the cost of material per tree is between ½d. and 2d. according to tree size.

METHODS OF SPRAYING

Spray thinning is not an easy technique to master. Very thorough spraying of the tree is necessary for it is essential to spray every open blossom. No half measures can be tolerated. The quantity of dilute spray material which must be applied to each tree varies between one and five gallons, according to tree size. Use of a fairly coarse nozzle speeds the work.

D.N.B.P. is an easy spray material to use since it mixes well with water and no spreader is required. The best method of mixing is to put a small quantity of water in the spray vat, then add the required amount of D.N.B.P., and finally fill with water.

Concentrations:

With regard to spray concentrations the grower should remember that the setting of all varieties varies with type of soil on which planted, age of tree, size of previous crop and irrigation practice. Seasonal conditions including mildness of winters also affect cropping. Growers may therefore find it necessary to amend the recom-

mended spray concentrations in the light of the condition of their trees and seasonal conditions, bearing in mind that lower spray concentrations will still effect some thinning. If there is any doubt regarding concentration to be used advice should be sought from the local Horticultural Adviser or Instructor.

Spray thinning normally leads to the production of a heavy crop in the following year, so once commenced it must be repeated.

VARIETIES

WICKSON

This variety, although exported in fairly large quantities, is not very popular on the local market where its delicate flesh and flavour are not appreciated. It is well suited to our climatic conditions and will set a crop when other varieties fail.

It has been the subject of a fairly detailed series of spray thinning experiments which early led to the conclusion that neither Sodium dinitro ortho cresylate, 3 chloro, I.P.C., 3 C. P., Alanap 3 nor Malic hydrazide were reliable thinning sprays for this variety. D.N.B.P., has however proved reliable over a number of years and has also been found to have the advantage of thinning less when setting is lighter than normal due to mild winter weather conditions.

Results from early experimental work with this variety included recorded thinning times as follows:—

	Average time to hand thin a tree Minutes
Sprayed with D.N.B.P. at 1 pint per 100 gals.	13½
Unsprayed	51½

On the other hand in the last years work results were assessed by counting blossom buds, which normally produce up to three flowers, and the subsequent set of fruit. These results are tabulated below:—

	Fruit per 100 Blossom Buds
EXPERIMENT 1.	
Sprayed with D.N.B.P. at 1 pint per 100 gals.	3.7*
Sprayed with D.N.B.P. at ½ pint per 100 gals.	6.8
Unsprayed	11.0
EXPERIMENT 2.	
Sprayed with D.N.B.P. at ¾ pint per 100 gals.	4.9†
Unsprayed	12.6
EXPERIMENT 3.	
Sprayed with D.N.B.P. at 1 pint per 100 gals.	1.1*
Sprayed with D.N.B.P. at ½ pint per 100 gals.	2.0
Unsprayed	11.3

* Overthinned. † Slightly overthinned.

Wickson plum spray thinned

Wickson plum unsprayed

Thinning is apparently greater in the last instance, but the actual result in quantity of fruit left on the tree was similar to that achieved in experiments 1 and 2.

Time of application was also investigated in experiment 3 with the following result:—

	Fruit per 100 Blossom Buds
Sprayed when 50 per cent. of flowers open	5.6
Sprayed when 75 per cent. of flowers open	2.1
Sprayed when 95 per cent. of flowers open	2.0
Unsprayed	11.3

From this it would appear that the orchardist should wait until three quarters of the flowers are open and then spray on the first available fine day and that spraying can take place over a period of three to four days. The over anxious grower should remember that plum blossom opens more slowly during wet weather when conditions are not suitable for spraying.

The spray thinning of Wickson plums gives a worthwhile increase in fruit diameter as the following examples will demonstrate:—

	Average Fruit Diameter Inches
EXPERIMENT 1.	
Sprayed at ½ pint D.N.B.P. per 100 gals.	2.08
Unsprayed	1.80
EXPERIMENT 2.	
Sprayed at ¾ pint D.N.B.P. per 100 gals.	2.13
Unsprayed	1.83
EXPERIMENT 3.	
Sprayed at ½ pint D.N.B.P. per 100 gals.	1.98
Unsprayed	1.72

These figures can be summarised as an average increase of ¼ inch in diameter. All treatments were hand thinned, so that this increase is due solely to spray thinning. It may be argued that an increase in size is of no advantage, since larger fruit does not command a higher export price but it does mean that:—

(1) Almost all fruit exceeds the minimum export size.

(2) Handling and packing costs per box of fruit are reduced.

(3) The shipping of larger fruit assists in holding valuable export markets.

Lastly with this variety spray thinning gives a considerable increase in growth. This is not necessarily a disadvantage as growers who spray thin may be able to prune their trees more lightly because the reduction of flower numbers by pruning becomes less necessary when crops are regulated by spraying.

WILSON

The Wilson sets perhaps the heaviest crops of all Japanese plums.

Recently a small quantity of fruit of this variety has been exported, the minimum size allowed being 1½ inches diameter.

It is difficult to get fruit up to this size in a heavy crop year without spray thinning. For example, in experiments conducted this year, the average diameters of a sample of 40 fruit per tree were as follows:—

EXPERIMENT 1.	Inches
Sprayed at ¾ pint D.N.B.P. per 100 gals.	1.57
Unsprayed	1.42
EXPERIMENT 2.	
Sprayed at ¾ pint D.N.B.P. per 100 gals.	1.58
Unsprayed	1.38

All trees were hand thinned.

Hand thinning occupies considerable time and in two experiments conducted this season the average time required to thin a tree was as follows:—

	Sprayed with D.N.B.P.	Unsprayed
EXPERIMENT 1:	58 min.	2 hrs. 46 min.
EXPERIMENT 2:	43 min.	2 hrs. 44 min.

This represents a reduction in cost of hand thinning from 20/6 to 6/3 per tree.

No difference in time of ripening between sprayed and unsprayed trees was noticed.

In the experiments conducted D.N.B.P. was applied at ¼, ½ and ¾ pint per 100 gallons but only ¾ pint gave sufficient thinning.

Time of spray application was also investigated but spraying when two thirds of the blossoms were open or when all blossoms were open gave the same result. Therefore trees should be sprayed when two thirds of the blossoms are open or on the first fine day following.

No spray other than D.N.B.P. appears to give satisfactory thinning.

The Wilson tends to bear biennially, particularly when grown on less fertile soils and without irrigation. Cropping can be completely biennial in which case growers may if they wish apply D.N.B.P. at 1 pint per 100 gallons with a view to correcting this tendency, but ¾ pint per 100 gallons is the general recommendation.

Finally this variety is very subject to manganese deficiency which may be corrected by a dormant spray of 30 pounds of manganese sulphate to 100 gallons of water. Manganese deficiency may affect both growth and cropping and should therefore be corrected.

SATSUMA

The Satsuma, like the Wilson, is notorious for its production of heavy crops. Although some Satsumas are exported production is mainly for the local market where large fruit always command higher prices. Hand thinning to produce large fruit is particularly difficult with this variety due to its dense foliage, under which much of the fruit is hidden.

In one experiment spray thinning reduced hand thinning as follows:—

	Average Time per Tree
D.N.B.P. ½ pint per 100 gals. at two-thirds full bloom	1 hour 2½ mins.
D.N.B.P. ½ pint per 100 gals, at full bloom	14½ mins.
Unsprayed	1 hour 21½ mins.

From this it can be seen that time of spray application is most important, more important in fact than the spray concentration used, so that it is essential to wait until the trees are in full bloom before spraying. Half a pint of D.N.B.P. per 100 gallons is adequate.

Spray thinning with this variety greatly increases the crop in the following year so that once commenced it should be continued.

The increase in fruit diameter resulting from this year's spraying was as follows:—

	Average Fruit Diameter Inches
Sprayed with D.N.B.P. at ½ pint per 100 gals.	1.92
Unsprayed	1.63

An increase of more than one quarter inch in average diameter was obtained which would lead to a considerable increase in market return.

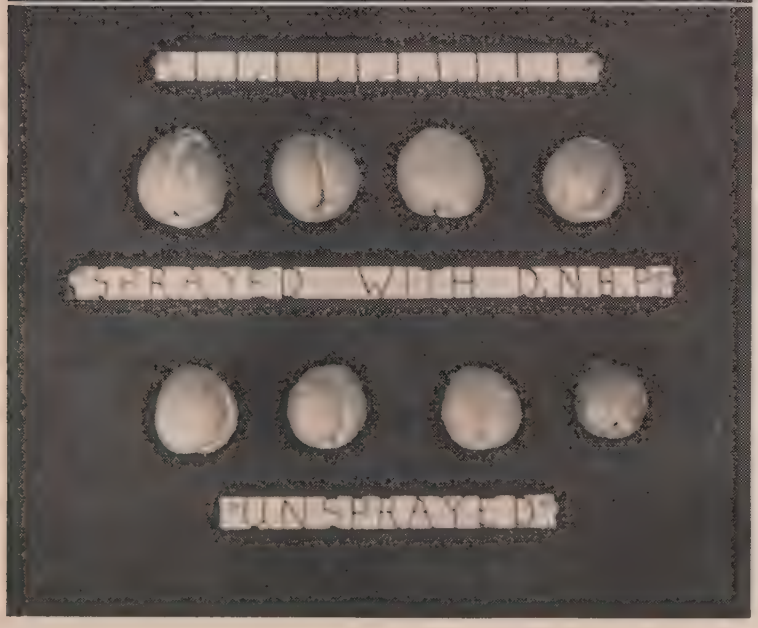
DELAWARE

This variety is little planted at present and production is declining. Spray thin-

ning can be successfully carried out but is a little difficult owing to the Delaware's long flowering season. Generally the best results are achieved when it is in full bloom. Growers whose trees do not flower together may find that groups have to be sprayed at different times but *on no account should any tree be sprayed twice, as over-thinning may result.*

One half or three quarters of a pint of D.N.B.P. per 100 gallons are suitable spray concentrations.

The effect of spraying on fruit size. Variety Satsuma



The effect of spraying on fruit size. Variety Wickson

In both cases scale above fruit in inches

Hand thinning times recorded during this year's work were as follows:—

	Average Time per Tree
Sprayed with D.N.B.P. at ¾ pint per 100 gals.	38½ mins.
Sprayed at ½ pint per 100 gals.	46½ mins.
Unsprayed	1 hour 19½ mins.

An increase in fruit diameter also follows spraying, but this increase may be rather slight.

WORK WITH OTHER VARIETIES

Experimental work with the varieties Ruby Blood, Narrabeen and Santa Rosa is in progress and will be reported when complete. From the results achieved so far it would appear that a tentative recommendation can be made for the Santa Rosa to the effect that it can be spray thinned with D.N.B.P. at ½ pint per 100 gallons. Spray concentration is more important than time of application.

SUMMARY

The present recommendations can then be summarized as follows:—

Varieties with which concentration is more important than time of application:

Wickson and Santa Rosa—½ pint D.N.B.P. per 100 gallons at 70 to 95 per cent. full bloom.

Wilson—¾ pint D.N.B.P. per 100 gallons at 70 to 95 per cent. full bloom.

Varieties with which time of application is more important than concentration:

Delaware and Satsuma—½ pint D.N.B.P. per 100 gallons at full bloom.

It must be emphasised that the advantages of spray thinning, which are a reduction in hand thinning, more regular bearing and larger fruit, can only be realised by thorough and careful spraying. Slipshod spraying is useless.

ACKNOWLEDGMENTS

Thanks are expressed to the following growers, who allowed the use of their trees for experimental purposes:— D McKinnon, Mayor and Brindle and C. Cappelletti, Parkerville; A. J. Broucke, Mt. Helena; C. Watson, Bickley; C. Della, D. Furfaro, Di Blasio and P. Travicich, Pickering Brook; S. Littley, Karragullen; L. Ward and A. Sharp, Kelmscott; B. V. Cross and Sons, Bedfordale; and H. Berle, Forrestfield.

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CITRUS PSOROSIS

By H. L. HARVEY, B.Sc. (Agric.), Senior Plant Pathologist

CAREFUL selection of propogating material will prevent the spread of citrus psorosis, a disease which reduces the yield and economic life of infected trees.

Psorosis (Scaly Bark) is a disease of world-wide occurrence on citrus trees and has been responsible for considerable losses to orchardists in some citrus countries.

In Western Australia, it has been present for many years but has so far only occurred on occasional trees in most orchards. In one or two cases, up to 10 per cent. of mature Navel orange trees have been found affected. The danger in Western Austraila is not therefore in the existing number of affected trees, but in the possibility of propagating from such trees in the future and thus spreading the disease.

Fig. 1: A small branch of ¾ in. diameter showing bark scaling. It was taken from a Psorosis-infected Valencia orange tree.

Fig. 2: A mature Washington naval orange tree showing bark scaling due to Psorosis. Trunk and main limbs are affected and the tree was partly defoliated and quite unprofitable at this stage.

SYMPTOMS

On the leaves, pale flecks and line patterns may occur, but these are rarely seen because they are inconspicuous and only appear for a very short time on young growth in spring or autumn.

The disease is seen mainly as a scaling and lifting or curling of the bark (Fig. 1),

when trees are approximately 12 or more years old. This condition is found mainly on the trunk, but may extend up the main limbs (Fig. 2). Scaling may involve relatively large pieces of bark or pieces as small as one inch in diameter. Gum may sometimes be associated with scaling of the bark. Affected trees decline in growth and yield with a dieback of branches, and may linger for some years before finally dying out.

CAUSE

Psorosis is caused by a virus which is spread from tree to tree in buds and grafts taken from infected parents for propagation purposes. There is no known natural method of transmission in orchards.

CONTROL

There is no spray treatment or surgical treatment which will cure a tree which is affected with Psorosis. Nor is there anything to be gained by reworking such trees, as the virus will spread into the new scion.

Propagating material should not be taken from a tree showing any symptoms of Psorosis as the progeny will in all probability be affected. In Western Australia where the incidence of Psorosis is low, the most reasonable approach to its control is to remove and destroy infected trees when they become unproductive and to use for replants or new plantings, trees propagated only from vigorous mature parents in the vicinity of 20 years of age which have remained free of Psorosis symptoms.

CITRUS CROP YIELDS DOWN

Abnormal spring and summer weather conditions have had a marked effect on crop yields of all citrus fruits, reports the Horticulture Division of the Department of Agriculture.

Warm dry spring weather was followed earlier than usual by hot summer conditions, with numerous centuries and hot, dry winds. Shedding of young fruit was consequently heavy, and in some orchards was accentuated by mealy bug and heavy scale infestations. There was little or no rain until March, when good falls eased the situation. Irrigation water was short in most districts. Despite the moisture stress the effect of the summer on fruit size was less than expected, and only in some non-irrigated orchards is fruit small.

The following crop estimates are based on figures from the Bureau of Census and Statistics, and refer to fruit from commercial growers only. The lemon crop estimate of 70,000 bushels would be considerably higher if fruit from non-commercial growers was included.

The current season's crop of lemons could be the lightest on record. This reflects the weak blossoming of lemon trees last spring, following two extremely heavy crops of the past two seasons. Poor setting of fruit was aggravated by heavy shedding during the summer. The summer lemon crop was also light.

It is estimated that oranges will also be well below last year's crop. Although navels blossomed profusely, heavy shedding of young fruit seriously depleted the crop. Setting was quite good in Valencias, but summer shedding was again heavy. Young trees of both varieties are carrying good crops. Fruit sizes are generally good. The total orange crop estimate is 330,000 bushels, made up of 155,000 bushels of navels and 175,000 bushels of Valencias. This too is likely to be one of the lightest on record.

Grapefruit and mandarins were less affected and are carrying better crops. Both are estimated at 19,000 bushels.

White Muscle Disease

Fig. 1: Inside wall of the heart (right) and two pieces of skeletal muscle, showing white streaks of degeneration caused by the disease. The colour picture was taken during post-mortem examination of an affected lamb at the Animal Health Laboratory last winter.

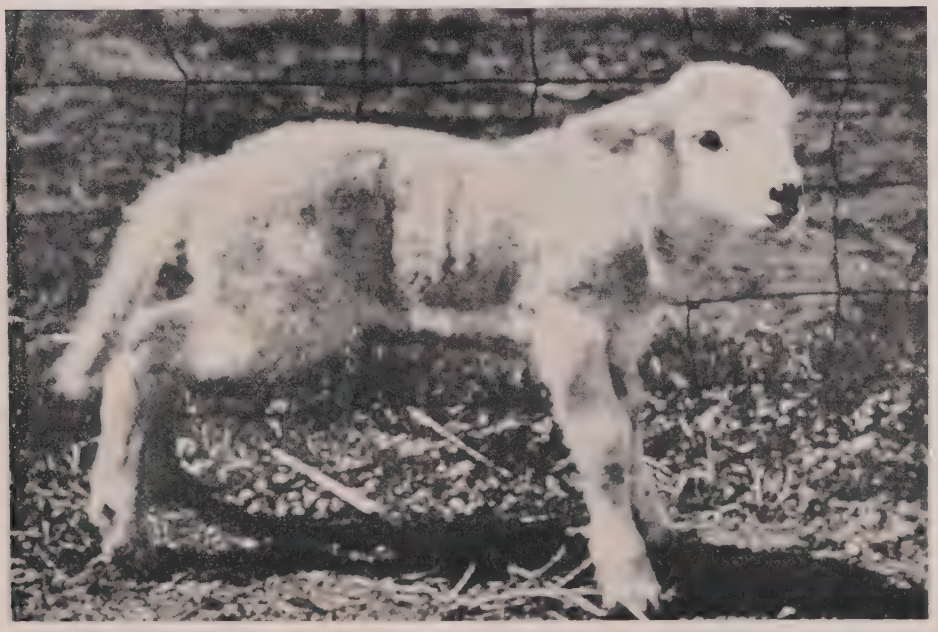


Fig. 2: Lamb with muscular dystrophy caused by white muscle disease, showing posture with feet widespread, and prominent shoulder blades. (From Marsh: Newsom's Sheep Diseases.)

WHITE MUSCLE DISEASE OF SHEEP

Symptoms and Pathology

By M. R. GARDINER, B.S., V.M.D.,
Chief Veterinary Pathologist

WHITE Muscle Disease (WMD) was recognised for the first time in Western Australian sheep during the winter of 1960. The first outbreak occurred on a property in the South Stirling district in the middle of July and this was followed by outbreaks in August, September and early October, at Mayanup, Kendenup, Mt. Barker, Duranillin, Kojonup, South Stirling and Pinjarra.

In each case, the disease was confirmed by pathological studies at the Animal Health Laboratory. Veterinary field officers of the Department of Agriculture have reported additional incidents of WMD during the same period mainly from the South Stirling, Mt. Barker, Albany area and one isolated confirmed occurence was found on a property south of Kojonup, in early January, 1961. This confirmation of the disease in several districts of the South-West Division strongly suggests that it probably caused lamb losses on many more properties than the 12 or 15 where investigations were carried out, either being not reported, or, more likely, not recognised as the cause of death.

Before going further into the circumstances which were operating on these properties to cause, or to pre-dispose to, the disease, it may be of interest to readers to have some background information on which an understanding of the nature of WMD may be attained.

Two other names—Muscular dystrophy and Stiff lamb disease—have been commonly used overseas to describe this condition of the young lamb characterised by breakdown (or necrosis) of skeletal muscle in all parts of the body and of heart muscle. First recognised as a clinical entity in Germany in 1925, it was reported during the next few years in the United States, in several European countries, in South America, in Japan and in New Zealand.

The symptoms appear most frequently in the first month of life but lambs as old as five or even six months may occasionally be affected. As far as we know lambs older than this are not susceptible. In some outbreaks, neonatal lambs may be affected and it is suspected that unborn lambs may sometimes develop the disease and be stillborn. Losses may be few, or a high percentage of the lambs of a flock may die.

It is important to realise that WMD outbreaks may run a rapid limited course with an abrupt cessation of new cases and with the recovery of many sick animals even though there has been no change in management, or in feeding, and no treatment has been instituted. Therefore, great caution must be used in the interpretation of the effect of any therapeutic method. This point is discussed below more fully in connection with specific remedies.

SYMPTOMS

The sick lamb has a stiff stilted gait and can rise only with difficulty. He stands with legs spread apart and head down, and the thorax appears to sag between prominent shoulder blades. Similarly the hindquarters are weak, and, if the heart is involved, the animal will show a markedly increased respiratory rate. Careful examination of these cases will reveal a fast weak heart action. A typically affected lamb is shown in the photograph.

There is no loss in appetite but ability to suckle is often impaired unless the lamb is carefully shepherded. Death may occur in 1 or 2 days following the appearance of the initial signs; it may be early and sudden due to heart failure, or, as mentioned before, the lamb may recover after a short period of muscular weakness. Survival is much more likely in those cases with little or no heart involvement.

DIAGNOSES

It is easy to diagnose a typical case of WMD post-mortem, provided that one takes care to examine the heart and skeletal muscles. The author believes that the disease may have been missed in Western Australia, in the past, due to failure to open up the heart or to slice the muscles of the hind legs or the shoulder girdle. Hearts affected with WMD, are shown in the accompanying photographs. The white, or nearly white, linear streaks of necrosis can be readily seen especially on the inside wall (endocardium) of the right ventricle. This is the smaller of the two main cavities of the heart. Sometimes the necrosis appears in the left ventricle or even in the auricles which are the two small cavities at the base of the heart. Typical necrosis may occasionally be seen on the outside wall (epicardium). The entire organ seems flabby and lacks normal tone.

Fig. 3.—Lesions of white muscle disease on the heart (From Marsh: Newson's Sheep Diseases)

The lesions in the skeletal muscles appear as pale white circumscribed streaks which contrast strongly with the reddish colour of adjacent normal muscle bundles. If enough muscles are sliced this contrasting picture of linear streaking and normal muscle fibres can almost always be found (see Colour Plate). Sometimes a paler edition of normal muscle may be mistaken for necrotic muscle.

The heart changes usually lead to disorders in other parts of the body. Perhaps the most frequent of these is congestion of the lung and the observer may be misled into thinking the animal has died of pneumonia. Of course pneumonia may actually be the terminal event but the basic cause—heart failure due to WMD—is the important one.

This description of symptomatology and pathology has been given as a guide to the livestock owner. Wherever possible confirmation of WMD should be obtained by a veterinary surgeon. Other diseases may occur in conjunction with WMD and may be important predisposing causes.

POSSIBLE CAUSES

It is a mistake to look upon this condition as a simple deficiency disease. The causes of WMD are complex and even today are not fully understood. In those parts of the world where it has been most completely investigated certain combinations of factors have been found to occur. Thus in U.S.A., feeding pregnant ewes on diets rich in lucerne or clover hays,

especially if grown on irrigated land, results in a high incidence of the disease in their lambs. For years this was thought to be due to a deficiency of Vitamin E in these hays, and, in fact, there have been many reports indicating that ewes supplemented with this vitamin (wheat germ is a good source) during late pregnancy will produce lambs much less likely to develop WMD. However, legumes associated with the production of WMD often have quantities of Vitamin E, on chemical analysis, as great as non-WMD feeds. Obviously then the condition is not an uncomplicated Vitamin E deficiency disease.

Recently, there have been some research reports which indicate that some legumes may synthesize agents which inhibit the normal metabolism of muscle

Fig. 4.—Heart opened to show lesions in the right ventricle
(From Nisbet, Butler and Macintyre: Muscular Dystrophy in Experimental Lambs)

cells, even though ample amounts of Vitamin E may also be present. It seems that cool weather combined with much rain favours the production of the inhibitor which may be one of the primary factors leading to outbreaks of WMD. The nature of the inhibitor is unknown although a number of substances are known which can experimentally induce the disease. Thus unsaturated fatty acids in the form of cod liver oil will often cause WMD. This form of the disease has been known for years in Scotland in calves given supplementary cod liver oil as an anti-rickets agent. It also appears that the natural inhibitor which is present in many WMD-inducing rations can itself be counteracted by substances present in other feeds. As neither the metabolic inhibitor present in the legume or the counteractant in the preventive feeds have yet been identified, further comment on this line of research is probably not profitable at present except to say that in the author's opinion, this approach is one of the most promising for future investigation.

Thinking on the fundamental nature of WMD took a new turn several years ago when it was shown, in New Zealand, that selenium could prevent or cure the disease in many districts where is was prevalent. This finding has been confirmed in other parts of the world where this trace element is deficient in the soils. Furthermore, it has been found that the added selenium will promote growth and improve fertility but probably only on properties where WMD actually occurs.

It appears, therefore, that there are at least three factors involved in the cause of WMD. These are:

(1) Deficiency of Vitamin E.
(2) Deficiency of selenium.
(3) Presence of a metabolic inhibitor in certain feeds.

To prevent the occurrence of the disease, *both* Vitamin E and selenium are probably needed in adequate amounts by the ewe for several months before lambing, and there must be an absence of the metabolic inhibitor in the ration of the lamb. Thus if the former are adequate and the inhibitor is present, WMD may develop. There is some evidence also that other minerals such as iron, cobalt and copper must be present in balanced quantities in the soil in order to prevent the disease. For instance, WMD is much more frequent in parts of Finland where cobalt and copper deficiencies are common.

WEST AUSTRALIAN OUTBREAKS

With regard to the Western Australian outbreaks, we have little or no information on the contributing factors, or on the presence or absence of essential vitamins, minerals or enzyme inhibitors in the maternal diet. The very few chemical

analyses done so far tend to show that both selenium and Vitamin E are probably supplied in adequate amounts on properties where WMD has been diagnosed. *But we emphasise that these findings are very preliminary and results of surveys now in progress should be awaited for more valid evaluation of these points.*

At present we can only speculate on the presence of a metabolic inhibitor, a view which receives some support in view of the occurrence of almost all our outbreaks in the three winter months in districts which were both wet and cold. With regard to the overall mineral balance on affected paddocks, we have little knowledge as yet.

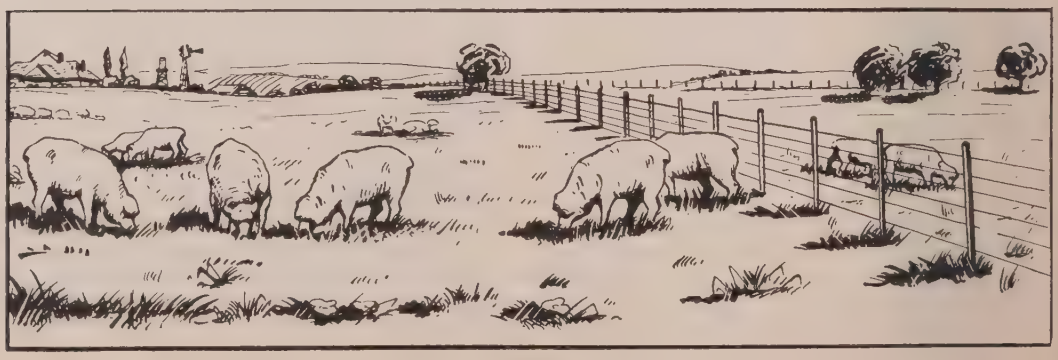
Finally, the influence of other diseases on the development of WMD cannot be ignored. A survey of the outbreaks of the disease last winter shows that at least one was associated with giving an arsenic-carbon tetrachloride drench, two with facial eczema hepatitis, one with a multiple deficiency syndrome and several with thyroid abnormality.

Enough has been said to indicate the great complexity of the WMD problem. *Graziers are urged to approach with great caution the promiscuous use of selenium, a substance of tremendous toxicity.* Even if selenium should prove to be deficient in the soils of this State, the most rigid control should be exercised in its use. On the other hand, it will probably be shown that there is no simple solution to the problem and therefore, it will be to the ultimate advantage of primary industry in Western Australia for sheep growers to bring unexplained lamb mortalities to the attention of veterinary field officers. It is very important that the facilities of the Department of Agriculture be enlisted so that co-operative research can eventually provide the information we must have, not only to control WMD, but also to determine the relationship, if any, between the factors giving rise to the disease and those involved in the more widespread condition of ewe infertility and unthriftiness of lambs.

A comprehensive programme is being set up this year in co-operation with the Veterinary Field Officers, the Animal Nutrition group and the Government Chemical Laboratories, the object of which is the study of selenium and Vitamin E content in the pastures, during the entire growing season, on properties where WMD has been previously diagnosed. Furthermore, when outbreaks occur, pasture samples will be collected for similar studies and affected animals will be sent to the Animal Health Laboratory for examination. Several drenching trials have already been carried out by veterinary officers with a view to determining the value of selenium in improving ewe fertility and lamb marking rates and preventing WMD.

ACKNOWLEDGMENTS

The author wishes to acknowledge, with thanks, the contributions which have been made to our understanding of the disease in Western Australia by Mr. J. Armstrong, B.V.Sc., Albany, and Mr. P. Lewis, B.V.Sc., Manjimup.



The rocky area to the right is a typical natural boundary. The fence along its edge does not cut through any cultivated area. In fact it separates arable land from non-arable.

NATURAL PADDOCKS HELP SOIL CONSERVATION

. . . says Soil Conservation Service Adviser G. W. SPENCER in this article, adapted from a series of A.B.C. radio talks.

ON most farms, particularly in the cereal and sheep districts, the paddocks as we know them are fenced off into neat squares or rectangles. The original fencing was done in such a way that the paddock layout, as well as the fences, completely disregards the topography or natural features of the land. Often this has encouraged soil erosion. In properly laid out paddocks there should be a very close relationship between the natural features of the farm, the fence plan, and soil conservation.

Now, a little more about these natural features. Actually, I think it's quite in order to refer to them as natural boundaries because that's what they really are, especially for soil conservation farm plans. For this farm planning, apart from farm boundaries and surveyed roads, the main natural boundaries we take into account are creeks and gullies, uneroded depressions, which shouldn't be cultivated anyway, especially if they carry water, rocky ridges and large clumps or belts of timber or scrub. Quite often, special areas such as salt land, sandy country and swampy areas can also be considered. With no fences at all then, most farms can be divided into natural paddocks by a number of these natural boundaries. This becomes very obvious if all these features, but none of the existing fences, are drawn onto a map of your farm.

At this stage, just think about your own farm. Try to visualise some of these natural paddocks. I'm sure you'll now

realise that most of the natural paddocks or natural cultivation areas are cut through with fences that make many sections almost impossible to work. On your own and other farms, how many paddocks do you know of with long narrow corners, many already gullied, washed out gateways, boggy and washed out wheeltracks, and firebreaks that are an erosion problem year after year.

I think you'll agree that fences can cause erosion. After all fences are permanent features that influence the pattern of cultivation, and the position of tracks and firebreaks. Surely then, if these fences are in the wrong place, something must go wrong with the tracks, the firebreaks and the cultivation. On the other hand, however, when fences are correctly located, erosion due to these things can be greatly reduced or even completely avoided. Also, if and when contour works are necessary, it is a lot easier to make use of them.

Eventually, old fences reach the stage when they need to be replaced, and many are now getting to just that stage. If for the last fifty odd years these fences have been the cause of much inconvenience, as well as a fair amount of erosion, there certainly doesn't seem to be any real reason for putting the new fencing in exactly the same place. Coupled with this is the fact that on most farms, even the existing water supplies can be made to serve more paddocks by a better arrangement of fencing.

Putting these ideas into practice is best done by obtaining a soil conservation farm plan. Quite a number of these plans have been prepared by the Department of Agriculture's Soil Conservation officers, but unfortunately it is not possible for the officers to prepare as many plans as they would like, or to prepare them as soon as they would like.

This should not stop the farmer from going ahead with his re-fencing programme; nor should it be an excuse for re-fencing on the present unsatisfactory layout.

A careful look at Department of Agriculture bulletin 2592 dealing with farm planning, should give a good idea of the general principles to follow. By applying these to his own farm any farmer can

This line of trees follows a large watercourse which should be regarded as one boundary for a natural paddock. The fence along this natural boundary can never interfere with cultivation.

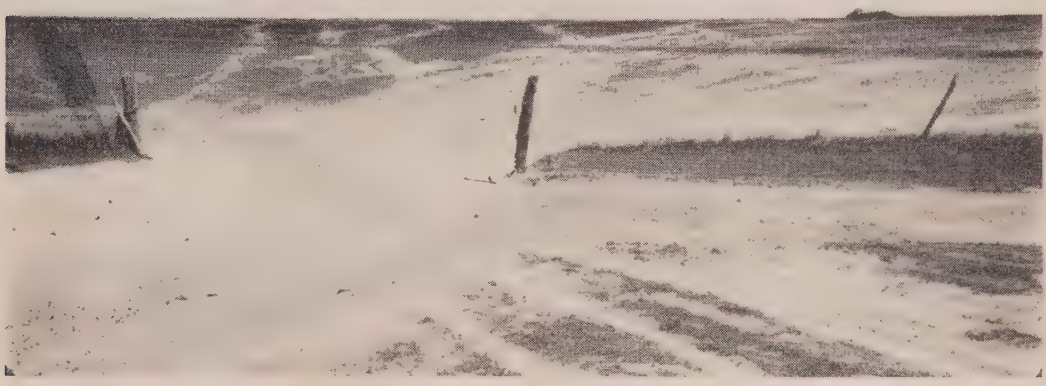
decide on a number of major fence lines —for example, one might be a fence along a main creek which runs right through the property. Such obvious and main fences could be planned and constructed immediately, as they would certainly fit into a complete farm plan which could be prepared later.

In this way, the farmer can start on re-fencing according to natural paddocks without having to wait for the complete plan.

do not, either directly or indirectly, cause erosion because of the way they influence the pattern of cultivation and firebreaks, and the location of tracks and roads.

The first point to think about when planning the subdivision of these large incomplete natural paddocks is probably availability of water in each paddock.

There is no point in putting in extra fencing to give another paddock unless there is a separate water supply in each of the new paddocks.



Erosion in this gateway is due to the top paddock not having its own water supply. Sheep grazing in that paddock have to travel through this gate each day to drink at a dam in the lower paddock. Subdivision fences should depend on the availability of water in each paddock.

SUBDIVIDING NATURAL PADDOCKS

Natural fence lines obviously make it much easier to plan a complete farm layout which not only enables easier farming in many ways, but also makes for safer farming, that is, soil conservation farming.

This idea of natural paddocks is very good for as far as it goes, but using only natural boundaries is never likely to give a sufficient number of paddocks, or paddocks small enough for the proper operation of a farm in the cereal and sheep areas. Quite often the natural boundaries do not completely enclose the natural paddocks. This means some subdivision fences will need to cut across good ground that can be cultivated. Special care is therefore needed to make sure that fences

For the benefit of the stock, water should be readily available, but in addition soil conservationists are particularly interested in how these water supplies can affect the paddock and the soil.

First of all, water in each paddock must result in more efficient grazing and this in turn means less overgrazing near water points, leaving a better plant cover on the soil. This added cover is a real factor in the control of both wind and water erosion. Another aspect is that these separate water supplies go a long way towards eliminating the all too familiar sight of the eroded gateway. In this case the damage has been caused mainly by the continual travelling of sheep with feed in one paddock and the water supply in another. This problem is best beaten

not by moving the gate, but by supplying water in each paddock.

Another factor closely linked with this is the economy of water reticulation.

Fortunately, water supplies such as soaks, wells and sometimes bores and dams occur either on or close to natural drainage lines and boundaries between different soil types. As these features can also be satisfactory paddock boundaries there is no problem in making use of the same water supply for 2, 3 or even 4 paddocks. Properly planned fencing can make more efficient and more economical use of existing water supplies—a most important consideration on properties where it is difficult to develop new water supplies.

Further, when the relative costs of extra fencing and piping water over long distances are taken into account, it soon becomes obvious that it is a much better proposition to run the fences through or to the water supplies than to reticulate the water several chains to the present paddock system.

PLANNING THE FENCING

Fencing should take into account not only existing erosion control measures but also any that may be intended or are likely to become necessary in the future.

It is therefore best to determine where contour practices may be necessary before deciding on the fence lines. When the only way to subdivide an area is with a fence downhill it should be placed directly downhill, that is, at right angles to the contour, and in cases where contour banks may be necessary the fence should not separate the natural waterway or water disposal system from the banked area. Building contour banks through fences should be avoided as much as possible.

Fences following eroded waterways should not be placed too close to the gully, because at some time in the future that extra space may be needed for work to stabilise and even completely reclaim the gully to the stage of growing a good grass cover.

In farm plans so far prepared, very little use has been made of contour fencing. When a contour fence is the only possibility it should be placed halfway between two contour banks and approximately following the contour in short strains of say 5 or 10 chains.

Another aspect closely linked with this is the safety of tracks and firebreaks, as well as cultivation.

When fences are placed on ridges, along the contour or at right angles to the contour, they are also either parallel to or at right angles to the general pattern of contour cultivation. This automatically makes such cultivation quite safe with very little in the way of inconvenient or awkward working.

This fence following the natural drainage line is out of the way of cultivation. In addition it makes it possible to use the same water supply for two paddocks.

This contour fence is a series of straight sections as close as possible to the contour. The farm road can follow the fence. In this case the road and the fence make a guide for contour working of the adjoining lands.

All roads and tracks around the farm should be properly formed so that correct drainage can be achieved. This presents no problem when the fences are already following ridges or are taken directly downhill. In somewhat the same way, firebreaks along the contours are quite safe, and when following fences downhill they can easily be made in such a way that they do not become erosion hazards.

The convenience of moving vehicles and stock around the farm will be a direct result of the way the fence layout is planned. A good system of all-weather tracks to all parts of the farm is an essential part of a well managed and smooth running property. Fences placed without regard to the need for such tracks will be a continual source of annoyance, inconvenience and an almost certain cause of erosion.

Economy of fencing need not always be a major consideration. Admittedly extra fencing should be avoided whenever possible, but the temporary inconvenience of paying for and erecting a longer fence needs to be carefully weighed against the long term advantages expected from putting in a fence that may be a few chains longer.

Paddock size is an obvious point to be considered in any farm plan, but it is also the most difficult to define.

The paddock size will depend very much on each farmer and his own ideas—whether he's essentially a cropping man or a sheep man, how many sheep he has and how many separate flocks he wants to run. General management methods and cropping rotation could also affect the number of paddocks and their size. It seems from plans so far prepared that paddocks can vary from 60 to 150 acres on farms of 1,000 to 3,000 acres.

One point worth making here is that it is not necessary to have a contour map of the farm to make up a farm plan. The plan is drawn up on the farm, which is itself a full scale model.

I have mentioned that the farmer's ideas, resources and management have a major influence on the fence plan finally prepared. For this reason, many of the points discussed can be put into effect whenever any new fencing is being done, without having to wait for a complete farm plan.

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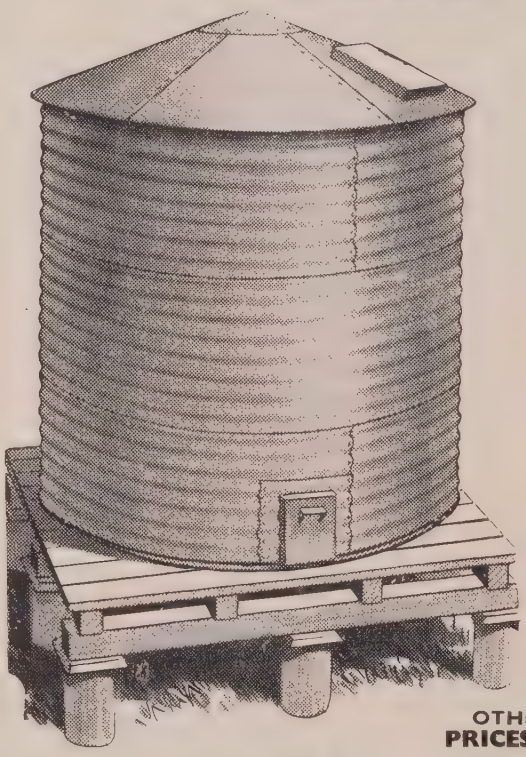

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Honey Flora Calendar for July

COMPILED BY R. S. COLEMAN, APICULTURAL SECTION, WITH ASSISTANCE FROM THE BOTANICAL BRANCH

Common Name	Botanical Name	Where Found	Honey		Quality of Pollen	Remarks
			Quality	Quantity		
One-sided Bottlebrush	*Calothamnus quadrifidus* R. Br.	Widespread in sand-plain	Poor	Good	Very good	Very poor honey.
Prickly Dryandra	*Dryandra armata* R. Br.	Gravel soil and sheet laterites: Midlands to Great Southern	Medium	Good	Good	Not well known.
Kerosene Bush	*Dryandra ashbyi* B. L. Burtt	Dongara and northwards. Some may be found south of Dongara in small patches	Good	Good	Good	A good flow usually follows good opening rains.
Fraser's Dryandra	*Dryandra fraseri* R. Br.	Gravel soils from Coorow through to Great Southern	Good	Good	Good	This plant is very much like the Kerosene Bush of the north.
White Bell	*Leucopogon conostephioides* D.C.	Widespread	Dark with strong caramel flavour	Good	Good	One of the most useful plants flowering at this time of year.
White Heath	*Leucopogon propinquus* R. Br.	Widespread	Poor	Good	Good	Time of flowering is important, to maintain hives in early winter and keep strength up for spring flows
Mothers Bells	*Leucopogon concinnus* Benth.	Widespread	Poor	Good	Good	As above.
No common name	*Leucopogon oxycedrus* Sond.	Widespread	Dark purple red honey	Good	Good	As above.
No common name	*Leucopogon oldfieldii* Benth.	Coastal plain and north sand plain	Poor	Good	Good	Another heath plant, about which not much is known.
Templetonia or Cockies Tongue	*Templetonia retusa* (Vent.) R. Br.	Coastal sand plain and limestone hills	Good	Fair	Good	Where weather is mild, builds up the bees.
Wild Radish	*Raphanus raphanistrum* Linn.	Widespread weed	Good	Good	Good	Excellent plant to build up hives and in some districts provides a surplus of honey.
White Bush	*Hakea trifurcata* (Sm.) R. Br.	Widespread	Poor	Good	Good	Important early pollen flow; builds up the bees for the Parrot Bush.

It will be seen from this list that information concerning many nectar-bearing plants is far from adequate. We would appreciate further information from beekeepers

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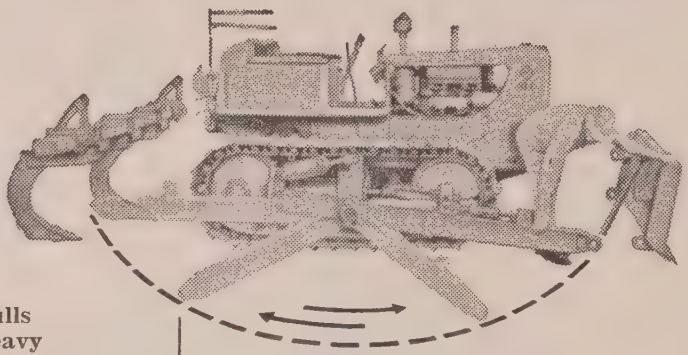

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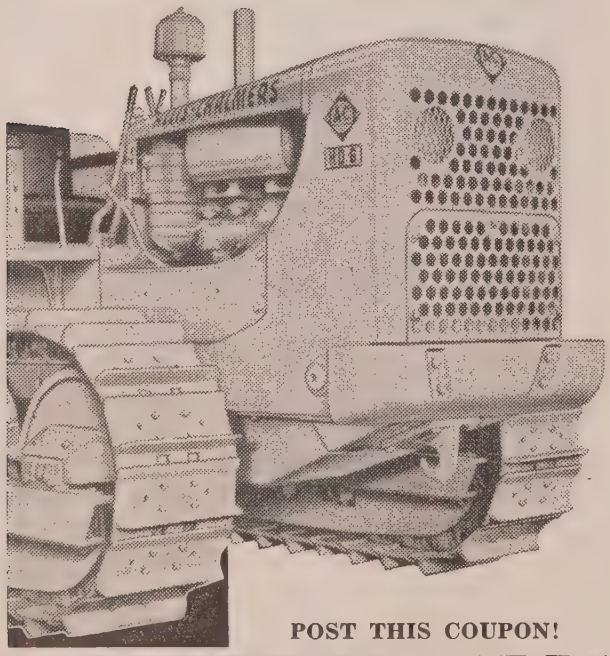

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Bee Farming

By R. S. COLEMAN, Officer-in-Charge, Apiculture Section

SUCCESSFUL COMMERCIAL BEE-KEEPING

THE eye of the master fattens the cattle. One of the oldest farming proverbs this is as true of bee-keeping as any other branch of farming. Careful husbandry is the basis of all successful bee-keeping; anything else is secondary.

Proper nutrition is the first requirement. Wherever possible the bees should be on a pollen and honey flow, and the hive never allowed to fall back in strength.

The hive field force must be kept "rolling" to maintain production. A hive with a full work force will get the most from any flow, but a colony which has been off a flow for three weeks will take up to three weeks before it completely recovers from the break in the brood raising. A hive which has been off a flow for six weeks or more will often take up to three months to become fully productive again.

The reason for this is to be found in the division of the labour force of the hive, and the reaction of bees to a period of dearth.

Their first reaction is to slow down the laying of the queen. This in turn means that six weeks from the time of the flow cutting out there will be a smaller number of bees emerging from their cells, progressively growing less as the number of nurse bees decreases.

A worker-bee has milk glands in her forehead with which to feed the larvae. When she first emerges from the cocoon, the young worker-bee cleans cells in preparation for the next batch of eggs, then starts to feed the older larvae with honey and pollen, progressively feeding the younger larvae as her milk glands mature. After about three weeks the young worker goes onto other duties.

After she has matured the worker can still feed the larvae, but less efficiently, so a colony with a smaller proportion of nurse bees cannot raise as many larvae as a well balanced hive. It is for this reason that any break in egg laying

means the equivalent break in the nursing population a little more than three weeks later, and three weeks later still a decrease in the foraging population and a continuing effect from the lack of nurse bees showing up in the numbers of bees emerging.

All this means that the hives must be kept up in strength at all times, unless another flow is not likely for some time, or a continuing flow is not available at all.

The secret of success in commercial beekeeping is therefore to keep the bees on a pollen or honey flow consistently the whole year round if possible. A consistent pollen flow is more important than a consistent honey flow, for pollen is required to supply the proteins and other necessary food for the young growing bees.

It is more important to produce honey of any kind than only first grade honey. From this arise four subsidiary but still important factors.

1. **Keep only young queens whose daughters have the genetic make-up to be prolific honey gatherers.**

While it is necessary for the beekeeper to be able to breed his own replacement queens it is extremely doubtful at the present price of queens whether it is economically sound for him to produce his own queens rather than buy them from recognised and reliable queen breeders.

The queen breeder of good reputation is proud of his good name, and besides making sure that he sells only good queens he is constantly trying to improve his breed. Few honey producing bee farmers have the time to pay the same sort of attention to the quality of their breeding stock.

A refinement which helps the beekeeper produce more honey during the honey flow is to keep a number of nucleii always available to requeen hives which show any sign of failing. Any failing hive noticed during the extraction round and immediately reinforced with a nucleus containing a high producing young queen will on the next round be producing as well as any other in the apiary.

2. **The bee-keeper must have a thorough knowledge of honey and pollen flora.**

The successful commercial bee-keeper knows completely the potentialities of every honey plant within 100 miles radius of his home.

He must visit all possible sites every year to keep abreast of the honey flow available, and to plan his moves.

3. **Adequate mechanical equipment is essential.**

His truck controls the number of hives the bee-keeper can run, and this is the most important item of his plant. It must be big enough to allow the apiary to be shifted quickly and efficiently.

The average bee-keeper working on his own can handle three loads of bees easily; four can still be handled but five become a poor proposition because by the time the last load is shifted the flow to which the bees are being moved has often been going for at least 15 days. If the distance shifted is over 250 miles—as is sometimes necessary—the flow can be going for up to 4 weeks before the last load is placed on it. It is then that bee-keepers tend to leave one or two loads of bees in the bush while they extract and care for the loads they have shifted. This not only wastes capital investment, but the bees left on the old site get down in strength and when they can be shifted are quite often no longer producing hives. Therefore a truck which can carry 120 hives is better than a smaller truck which is fully extended carrying 80 hives.

Added to this is the shifting cost factor. If the cost of shifting is £6 a hive using the small truck the cost a hive with the larger truck will be about £4. One man with a small truck cannot comfortably handle more than 240 hives while one man with a larger truck could handle 350 hives.

The other major item is the extracting van. This should be designed to extract all hives in 10 working days. One man should be able to handle the van but it should still be convenient and efficient when used by two men during a heavy flow.

There are many different views on the layout of the interior of the extracting vans. Any bee-keeper should make him-

self familiar with as many extracting vans as possible before he builds or buys.

4. **Material in the hives must be maintained at a high standard.**

The combs are the most important. They must be kept in good condition and free of drone comb if the hive is to remain productive and at full strength. The drone combs should be weeded out at regular intervals. Any frame with more than 25 per cent. drone cells should be melted down.

If the hives are kept constantly on a flow wax moth is not a worry; it becomes an active threat only when the hive dies out and the colony is not inspected for some time.

All these factors make the successful bee farmer and each one is important; each is needed to complete the whole commercial beekeeper.

(Future articles in this series will discuss each of these four major requirements in detail.)

CAUTION NEEDED IN ANTIBIOTIC FEEDING OF PIGS

PIG breeders are warned to be cautious in their approach to the use of antibiotics in pig feeding.

Feeding broad spectrum antibiotics has been widely advocated for making young pigs more thrifty and improving growth rates, and low level feeding of antibiotics can indeed be valuable when used carefully where sanitation is not ideal.

But if feeding with these antibiotics is injudicious they can be harmful, warns Chief Veterinary Pathologist, Dr. M. R. Gardiner. A recent case of bowel upset investigated at the Animal Health and Nutrition Laboratories proved to be caused by an imbalance of the intestinal flora, following over-enthusiastic use of antibiotics.

The farmer in question had been troubled by epizootic diarrhoea in his herd for about two years, and despite all treatment it persisted, and even became worse in succeeding litters.

Study of the history of the case suggested the trouble was co-incident with the use of several broad spectrum antibiotics, particularly the tetracycline group.

Intestinal cultures showed that coliform bacilli (organisms common in the gut but normally harmless) were completely resistant to tetracyclines, chloromycetin and erythromycin, but were sensitive to streptomycin. These organisms had become predominant in the gut and there had been a corresponding decrease in other organisms, due to prolonged treatment with antibiotics to which the coliforms had become resistant.

The resulting imbalance of micro-organisms in the gut apparently affected the normal end products of digestion in some way, producing the diarrhoea—and a bad setback to the growth of young pigs. This is in line with overseas reports of coliform organisms developing immunity to broad spectrum antibiotics following misuse of the drugs.

In this case, the owner was advised to switch to a different antibiotic. There was apparently no good reason for his use of broad spectrum antibiotics in the first place, as sanitation was unusually good in his shed.

Unless there is some definite indication that broad spectrum antibiotics are needed they should not be used, says Dr. Gardiner.

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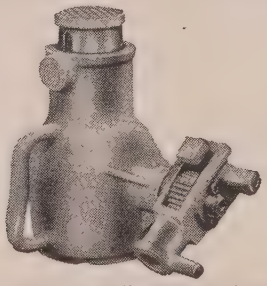

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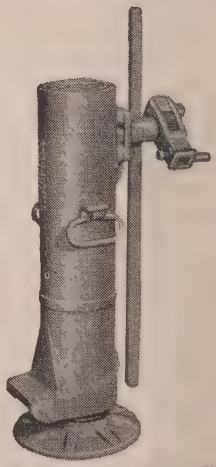

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FLOODING OF SALT LAND

By C. V. MALCOLM, B.Sc. (Agric.), Soils Division

MANY farmers have expressed concern and some have gone to considerable expense in trying to alleviate flooding problems on salt affected land. Some consideration will be given here to flooding, its causes, effects on salt encroachment, methods of prevention and alleviation.

WHAT DOES FLOODING DO?

1. Salt and Soil Movement.

It has often been suggested that flood water carries salt and salty soil from one area to another and thereby causes salt problems on previously unaffected country. A careful consideration of the facts gives little support to this theory. Sampling in the wheatbelt on a number of occasions during winter has indicated that *flood waters generally contain an insignificant amount of salt.* Any soil which is carried by flood waters has always been thoroughly washed of any dissolved salts during transport. Some salty soils however, have a very poor structure and if deposited in a thin layer on the surface of unaffected soil may give a plant establishment problem and aggravate salting. In practice, the *movement of soil by flood is usually from fresh to salty areas and contamination is unlikely to occur.*

2. Water Table.

Does floodwater cause a rise in the water table? Groundwater investigations carried out in the past few years by officers of the Department of Agriculture have indicated that most wheatbelt valleys where salt problems occur are underlain at shallow depth by a water table containing more salt than sea water. This is supported by the experience of farmers searching for water or sinking dams. Moreover, this salty water is actually under pressure and rises towards the surface when holes penetrate the

Floodwaters which take more than a few days to disperse aggravate salt problems

Roads sometimes restrict flow, usually for a short period only. A low land gradient and the road caused this temporary lake to form

water-bearing layer. The movement of water in the soil in these valleys is therefore towards the surface from the deeper layers.

It is most unlikely that surface waters could contribute to such a water table. The water table is fed by underground water movement from higher ground.

3. **Plant Growth.**

The effects of flooding on plant growth are obvious in wet seasons. Areas which remain under water for periods of more than a few days are often unproductive and remain bare during the subsequent summer. Any factors which cause potentially salty soils to be bare during the late winter and spring months provide ideal conditions for the accumulation of salt at the soil surface and hence the development of a salt problem. This means that wherever flooding causes decreased growth on potentially or actually salty soils it aggravates the salt problem. The removal of top soil by flood waters is obviously also detrimental.

WHAT CAN BE DONE TO ALLEVIATE FLOODING?

1. **Catchment Area.**

Flood waters are usually the result of run-off from sloping country; the contribution from flat land is usually negligible. It is therefore highly important to pursue methods of agriculture which will retain and use the rainfall where it falls. The most effective means of holding rainfall is to maintain a vigorous plant growth on the soil; this will in turn keep the soil in good condition for water penetration. Where slopes are excessive soil conservation methods involving contour cultivation and contour and grade banks should be employed.

These measures are far more important than those which can be used in flat country. Not only is production on the hillside as well as on the flat improved, but use is made of water which, otherwise, constitutes a menace.

2. **Flat Country.**

Many reports are received of farmers having large acreages of low-lying land covered with shallow sheets of water. In many cases this water takes more than a few days to dissipate and therefore aggravates any salt problems which may exist. A number of farmers have gone to considerable expense to drain it from their land. These efforts must be considered in the light of the value of the increased production likely to accrue. In general, it is difficult to drain these sheets of shallow water because of the lack of the fall in the paddock itself and from the paddock to the point of disposal for the water. Usually the best approach is to try to remove the water by broad shallow drains up to eight inches deep, which follow the lowest levels in the paddocks concerned. Low banks may also be used to confine water which, otherwise, would spread from channels across flat paddocks.

Drains suitable for removing shallow sheets of water may be made as above. Water can flow into these from both sides

The greatest limiting factors in efforts to clear water from salt land are having sufficient fall to give flow and having somewhere to dispose of the water safely. Care must be taken not to cause water hazards on adjacent property as this may lead to legal action.

The usefulness of drainage in dealing with salt problems is restricted to the control of surface water. It is not possible to economically construct drains which have any effect on a water table 3 ft. or more beneath the surface.

CO-OPERATIVE EFFORT

Flooding problems often are common to a number of farms in one catchment area. Some farms may be sources of flood water while others are traversed by flood waters which do not arise within their boundaries. This is an opportunity for co-operative effort for mutual benefit. Soil conservation practices employed on the water source properties will increase production on these, at the same time alleviating flooding in properties downstream on the flat. Co-operation may involve the planning of systems for the control of flood waters. *Such co-operative effort will obviate the likelihood of one farmer's work being spoilt by another farmer's neglect.*

ROADS

Complaints are received from farmers who consider roads are aggravating their salt problem by restricting flow of flood waters. As has been explained, flood waters which dissipate within a few days do not cause serious damage on salt land.

Once again co-operation is called for. Road Boards and the Main Roads Department have an unenviable task in maintaining roads across salt affected country, especially in areas where poor farming results in large amounts of run-off from adjacent farms and where clearing new land in the district results in an overall increase in run-off since road foundations were placed. The need for tolerance and a broad approach to the overall problem of making the most of our limited rainfall is obvious. The door is open for co-operative effort, in this case between farmers, road authorities, and Soil Conservation Officers of the Department of Agriculture.

Sloping cultivated soils erode and give birth to flooding on lower ground. Contour working and banks would have prevented this washout from occurring

IN BRIEF

- Flooding may aggravate salt problems in flat valleys in the wheatbelt. The most important preventive measures concern retention and use of the rainfall on the hillsides where it falls.
- Measures aimed at controlling flood water on flat country are of some use. In general, the problem of flood control must be viewed from the point of view of the whole catchment and involves co-operative effort on the part of farmers and civic authorities.
- Farmers worried by flooding are urged to contact the Department of Agriculture, the road authorities and their neighbours in a spirit of co-operation and with a willingness to do all in their power to tackle their share of the problem.

SALTLAND DEMONSTRATIONS WORTH SEEING

THE Soil Research Section of the W.A.D.A. has in the last few years established trial plantings of salt tolerant plants on a number of properties throughout the wheatbelt. These plantings all include bluebush, creeping saltbush and old man saltbush.

Some sites also have plantings of Puccinellia, a salt tolerant grass introduced to Western Australia from Turkey by the C.S.I.R.O. Farmers with saltland problems are recommended to inspect any of the plots listed below with the permission of the farmer concerned.

Coomberdale—Mr. R. Tonkin.
Koorda—Mr. G. Lodge.
Welbungin—Mr. E. Probert.
Bolgart—Mr. E. House.
Quairading—Mr. R. Lyall.
Bruce Rock—Mr. E. Endersee, Mr. R. Shields.
Narembeen—Mr. H. Cook.
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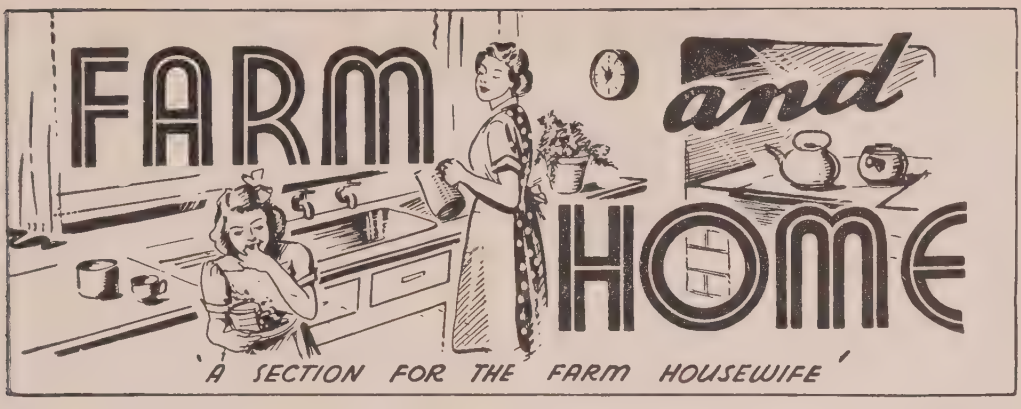

Suet for Winter Energy

By HELEN M. GLOSTER

WINTER weather is here again and the housewife will find she needs to provide the family with more substantial satisfying meals than in summer. Foods which supply heat and energy are necessary to maintain the heat of the body. We get this from foods containing starch, sugar and fat.

Most fats are expensive. The cheapest fat available is suet, which is both nourishing and wholesome. The solid fat which surrounds the kidney is considered the best; it should be fresh and of good quality, firm and dry. Beef suet should be cream coloured or pale yellow while mutton suet should be white and waxy. Beef suet is richer in flavour than mutton suet, is easier to digest and is better absorbed by the digestive system. Veal suet has a delicate flavour.

A great variety of dishes, both savoury and sweet, can be made with a simple suet paste as a foundation. I cannot imagine anything more appetising on a cold winter's day than a good steak and kidney pudding. It is specially recommended to the farm housewife to serve up to the men after a long tiring day at the plough or to the children when they return home from school on the bus.

The foundation for these puddings is a simple mixture of flour, suet, salt and water. If baked in the oven little or no baking powder is used, and the result is a pastry very similar to short pastry. The paste is usually cooked by boiling or steaming in which case it is necessary to use self-raising flour or plain flour to which baking powder has been added.

Breadcrumbs may be substituted for part of the flour if desired in most recipes and a little dry mashed potato may be substituted for some of the flour in the paste used in savoury recipes.

When self-raising flour is included in any recipe, its strength may be reduced by measuring half plain and half self-raising flour.

Suet paste is sometimes formed into dumplings and cooked in the steam on top of a soup or stew.

FOUNDATION RECIPE

Ingredients:

8 oz. plain flour.
2 level teaspoons baking powder; or 8 oz. S.R. flour, or ½ plain and ½ S.R. flour.
½ level teaspoon salt.
4 oz. beef suet.
Water or milk to mix.

Method:

1. Remove the skin and connective tissue from the suet, shred and *chop finely* using a little of the measured flour to prevent suet sticking to the knife. A pointed chopping knife is best for this purpose.

2. Add remainder of flour, sifted with baking powder and salt.

3. Mix in sufficient liquid to make a soft light elastic dough. Stir with a knife.

4. Turn into the centre of a "proofed" pudding cloth (or use according to instructions for individual recipe).

5. Tie firmly with string leaving room inside the cloth for expansion of the pudding.

6. Put into *fast boiling* water. Keep boiling 1½ to 2 hours. Lid should be tight fitting.

7. Lift out and drain on a colander, untie the string.

8. Turn on to a hot plate and serve with hot jam, golden syrup or sweet white sauce, or

Cut in slices, sprinkle with pepper and serve with corned or roast beef. Pour gravy over the cut pudding when serving with a roast.

Note.—Puddings may be steamed instead of boiled; they are lighter in texture but take much longer to cook.

Dumplings

The paste may be formed into small balls and placed on top of a stew or into pea soup half to three quarters of an hour before serving.

Serve in the soup or with the stew.

To Proof the Pudding Cloth

1. Have a strong clean pudding cloth of unbleached calico.

2. Gather corners of the cloth in the hand and dip centre of cloth into a saucepan of fast boiling water.

3. Press the lid of the saucepan down on to the cloth and the saucepan and draw out the cloth.

4. Sprinkle with flour while still hot. (This is a rough quick method of starching the cloth which blocks the spaces between the threads, preventing water from entering the pudding while cooking.)

PORK AND ONION DUMPLING

Ingredients:

Suet paste (6 oz. self-raising flour.)
1 large slice lean pork.
2 or 3 large onions.
Salt, pepper.
Herbs (if liked.)

Method:

1. Make paste and roll into a circle.

2. Place a layer of sliced onion on the paste and place pork on this.

3. Sprinkle with seasoning then add another layer of sliced onion.

4. Fold edges of crust to the top carefully, so that filling is entirely enclosed.

5. Tie in a pudding cloth, boil for two hours.

SAVOURY DUMPLINGS

Ingredients:

4 oz. self-raising flour.
2 oz. suet.
Bare teaspoon mixed herbs.
1 teaspoon chopped parsley, water to mix.

Method:

1. Make dumplings about size of a golf ball.

2. Cook in pot of soup or on top of a beef stew.

CHICKEN DUMPLINGS

Ingredients:

4 lb. stewing fowl cut into serving portions.
2 level teaspoons salt.
½ level teaspoon celery salt.
Pepper to taste.
2 cups boiling vegetable water or plain water.
Suet paste.

Method:

1. Place chicken pieces in a six-pint saucepan, breast pieces on top.

2. Add seasoning then boiling vegetable water, cover.

3. Simmer about 3 hours or until flesh is tender.

4. When nearly cooked add prepared dumplings.

5. Continue cooking half to three-quarters of an hour.

N.B.—Add extra liquid if necessary and bring to simmering point before adding dumplings. Dumplings are cooked in the heat from steam arising from the liquid. A tight fitting lid is essential.

DUMPLINGS IN SYRUP

Ingredients:

Suet paste.
1 cup water.
½ cup golden syrup (with a little treacle added if liked.)
1 teaspoon of lemon juice.

Method:

1. Prepare suet paste.
2. Put water, syrup and lemon juice on to boil.
3. Form dumplings from paste by rolling in floured palms of hands to form balls about the size of golf ball.
4. Drop dumplings into boiling syrup and cook for about 45 minutes. Keep a tight fitting lid on saucepan.
5. Serve at once with syrup poured over dumplings.

"FITLESS COCK" OR MEALY DUMPLING

From Scotland comes this unusual recipe.

Ingredients:

1½ teacups finely chopped suet.
2 teacups oatmeal.
1 onion.
1 egg.
Salt and pepper.

Method:

1. Mix prepared suet and oatmeal.
2. Add chopped onion and seasoning, mix well.
3. Bind together with beaten egg.
4. "Proof" a pudding cloth then turn dough on to it.
5. Form dough into the shape of a "fitless cock" using the floured hands.
6. Roll up loosely in cloth and tie securely.
7. Put into a pan of boiling water and cover.
8. Boil steadily for at least 2 hours adding more boiling water as required.
9. Remove cloth when dumpling is cooked and serve on a hot plate.

N.B.—The mixture could be made into small dumplings and cooked in a pot of soup.

A little self-raising flour or a level teaspoon of baking powder may be added to the above recipe.

ROLY POLY PUDDING

Ingredients:

Foundation paste (8 oz. flour.)
Jam or other filling.

Method:

1. Make paste and roll to an oblong ⅓ inch thick.
2. Spread with jam or other filling to within 1 inch of edges.
3. Dampen edges, roll up and press edges well together.
4. Wrap in greaseproof paper then in "proofed" cloth allowing for expansion when cooking.
5. Tie ends and put in saucepan of fast boiling water.
6. Boil 1½ to 2 hours.
7. Serve with sweet white sauce.

"SPOTTED DOG"
(Otherwise known as "Spotted Dick")

This is a great favourite with children.

Ingredients:

8 oz. self-raising flour.
2 tablespoons sugar.
4 oz. shredded suet.
2 tablespoons washed currants.
Little chopped lemon peel if liked.
½ level teaspoon salt.
Water to mix.

Method:

1. Make paste adding currants and peel to mixture, shape into a sausage 2 or 3 inches thick.
2. Tie in a proofed cloth as for roly-poly pudding.
3. Boil or steam.
4. Serve hot with sweet white sauce.

FRUITY SUET PUDDING

Ingredients:

4 oz. self-raising flour.
Pinch salt.
2 oz. beef suet.
2 level tablespoons sugar.
3 or 4 heaped tablespoons mixed dried fruit.
½ level teaspoon mixed spice.
Milk or egg and milk.

Method:

1. Prepare as for "Spotted Dog" but turn mixture into a greased basin or jam tin.

2. Cover with greased paper and steam for 2 hours.

3. Serve with sweet white sauce.

STEAK AND KIDNEY PUDDING

Ingredients:

Foundation suet paste (8 oz. self-raising flour.)
1 lb. steak (topside.)
1 or 2 sheep's kidneys (optional.)
1 heaped tablespoon plain flour, vegetable water (or water.)
2 level teaspoons salt.
1 onion.
Pepper.

Method:

1. Put a large saucepan of water on to boil.

2. Grease the pudding basin and "proof" a pudding cloth.

3. Cut steak into half-inch cubes, kidney into fine dice.

4. Toss the meat in flour, salt, pepper, add chopped onion and mix.

5. Make the suet paste and roll it out into a large round with a diameter to equal the outer measurement of the basin.

6. Cut a wedge from the round of paste (about $\frac{1}{3}$ to $\frac{1}{4}$). This wedge is used for covering the top.

7. Line the basin with the main piece of paste joining the cut edges along one side.

8. Fill the basin with meat mixture, add sufficient vegetable water or water to cover the meat.

9. Knead up the remaining piece of paste *lightly* and roll into a round to fit the top of pudding.

10. Cover pudding with paste, sealing the edges by pressing together.

11. Cover with "proofed" cloth. Tie securely leaving room for expansion.

12. Place into fast boiling water.

13. Keep *boiling* 3 to 4 hours, replenishing with *boiling* water if necessary.

14. Lift pudding from saucepan, drain for a minute or two then remove cloth.

15. Make a hole in the centre of cloth and fill up with hot water or hot stock.

16. Fold a table napkin around basin and place on a meat dish before taking to the dinner table.

17. Serve with vegetables.

APPLE PUDDING

Ingredients:

Suet paste (6 oz. self-raising flour.)
1 lb. apples.
$\frac{1}{2}$ cup sugar.
Squeeze lemon juice or strip of rind.
2 cloves.
$\frac{1}{4}$ cup water.
A little powdered cinnamon (if liked.)

Method:

1. Make in a similar manner to steak and kidney pudding, using sliced apples.

2. Boil 2 to 3 hours.

3. Serve hot with sweet white sauce.

APPLE AND RHUBARB PUDDING

This is made in a similar manner to apple pudding.

Ingredients:

1 lb. apple and rhubarb mixed.
$\frac{1}{2}$ cup sugar.
$\frac{1}{4}$ cup water.
A little grated orange rind.

From Luton in Bedfordshire comes this ingenious recipe.

BEDFORDSHIRE CLANGER

Ingredients:

Foundation recipe (8 oz. self-raising flour.)
6 oz. minced stewing steak.
1 onion.
Stock.
Salt, pepper.
Jam.

Method:

1. Make a stiff paste, roll out into an oblong.

2. Cut off a small piece of crust and put in lengthways down the middle. This divides paste in two.

3. Mix steak and minced onion, moisten with stock, season. Put on one half of paste.

4. Spread the other half with jam.

5. Damp the edges, roll up tightly and roll up in a "proofed" cloth.

6. Leave room for expansion when rolling, tie ends securely.

7. Put into fast boiling water and boil at least two hours.

8. The meat course is served first and then the sweet course.

N.B.—This is not recommended as a sample of a well balanced meal. It would to say the least be more than satisfying even on the coldest winter's day.

COLLEGE PUDDING

Ingredients:

4 oz. self-raising flour.
4 oz. breadcrumbs.
3 oz. suet.
Rind 1 lemon.
3 oz. raw sugar.
Level teaspoon mixed spice.
1 egg.
½ cup hot milk.
3 tablespoons currants.

Method:

1. Chop suet, using some of measured flour.

2. Add all dry ingredients, mix well together.

3. Make well in centre, gradually add beaten egg and hot milk. Beat together for a few minutes.

4. Half fill small greased tins and bake in a moderate oven until well risen and firm to the touch—about half an hour.

Turn out and serve with custard.

SQUAB PIE

Ingredients:

2 lb. neck chops (lamb or mutton.)
2 lb. apples.
1 lb. onions.
1 tablespoon of mushroom ketchup or dehydrated mushroom soup.
¾ cup vegetable water (boiling.)
Sugar.
Salt.
Pepper.
Suet pastry (6oz. flour.)

Method:

1. Divide chops into serving portions and place them in a pie dish and season with salt and pepper.

2. Slice apples and onions and place a layer of each on top of the meat.

3. Sprinkle with sugar.

4. Make the suet paste.

5. Half fill the pie dish with boiling vegetable water, *just* before adding suet crust.

6. Cover with crust and bake in a hot oven.

7. Reduce the heat when crust is brown and continue baking for 1½ hours.

Before serving, pour off gravy, skim, add ketchup, then return to pie dish. If dehydrated soup is used, it should go into the pie before being covered with paste.

N.B.—Gravy may be thickened, if preferred.

PLUM PUDDING OR CHRISTMAS PUDDING

Ingredients:

1½ lb. finely chopped suet.
1 lb. eggs (weighed in the shell.)
1 lb. dried plums.
1 lb. mixed peel.
1 lb. raisins.
1 lb. sultanas.
1 lb. currants.
1 lb. flour.
1 lb. sugar.
1 lb. brown breadcrumbs.
1 heaped teaspoon mixed spice.
½ nutmeg grated.
2 teaspoons salt.
½ pint new milk.
Juice of one lemon.
1 large wineglass brandy.

Method:

1. Stone and halve the plums, cut, peel into long strips.

2. Mix dry ingredients.

3. Moisten with eggs beaten to a froth, and milk, lemon juice and brandy.

4. Stand at least 12 hours in a cool place, then turn into greased moulds.

5. Boil for eight hours.

6. Boil a further two hours before serving.

This recipe will make three puddings of three pounds each.

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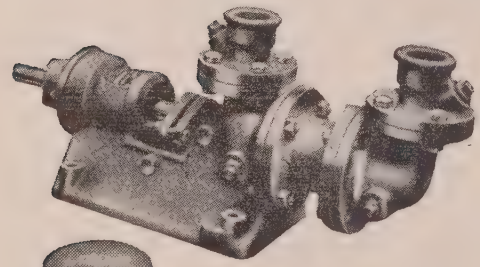

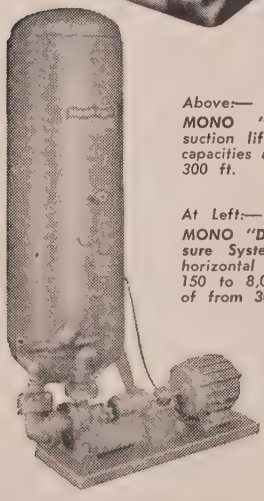

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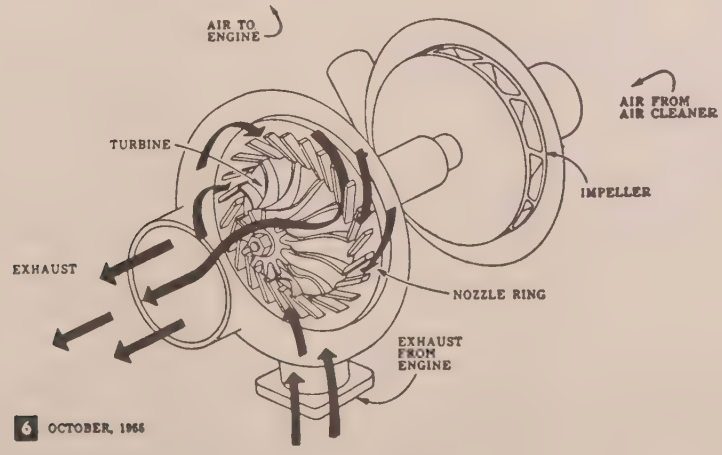
1.—Test Procedure.

The method of test is based on a procedure standardised by the Society of Automotive Engineers (U.S.A.). This consists of feeding a weighed quantity of carbon particles of given size into the exhaust of the working engine, and then catching in a trap, and weighing, the particles that the arrester allows to pass through. Separate runs are conducted with particles of larger and smaller size; in some runs the engine is working at full load, in others at fast idle under no load.

* The Australian Tractor Testing Committee is a joint body established by agreement between the Commonwealth, the States, and the University of Melbourne; under this agreement the tests are carried out by the University of Melbourne. The address of the Tractor Testing Committee is: c/o Department of Primary Industry, 301 Flinders-lane, Melbourne.



Schematic diagram of Turbocharger

According to the S.A.E. standard, no particles of the larger size should escape the arrester, and not more than 10 per cent. of the smaller size. At the same time the extra back pressure imposed on the exhaust system by the presence of the arrester should be no more than 10 inches in a water barometer.

2.—Identification.

Name: Caterpillar D7 Turbocharger.

Submitted by: Caterpillar of Australia Pty. Ltd.

For Particular Tractor: Caterpillar D7.

3.—Brief Specification of Arrester.

Operating Principle: Reduction of carbon particle sizes.

Declared Maximum Horse-Power: 140.

Mounting: Under engine cowling, ahead of operator, effluent upwards.

Details of Test Engine: Caterpillar type D339 4-cylinder diesel; 140 horse-power maximum; 831 cubic inches; rated speed, 1,200 r.p.m.

4.—Summary of Test Results.

(Particles injected at rate of 100 gms. in five minutes.)

(a) Effectiveness of Spark Arresting:—

Particle Size	Engine Load Condition	Carbon Passing Arrester (Per cent.)	Remarks
Large	High	Nil	Two tests
Large	Low	Nil	Two tests
Small	High	0·6	One test only
Small	Low	Nil	Two tests

(b) Back Pressure: Not relevant, since the Turbocharger is integral with the engine, and since no other spark arresting device was added.

(c) Temperatures: Ambient air—75° F. Body of Turbine—680° F. approximately.

(d) Noise Levels: Not taken.

5.—Comment.

(a) Most of the sample weight injected passed out as dust through the 28-mesh gauze outlet of the test trap. Between 20 per cent. and 40 per cent. was recovered in the form of particles finer than the "small" (25 mesh) size.

(b) The low load tests were carried out with no load at 700 to 800 engine r.p.m. A series of trials at lower speeds showed that some particles would pass through the turbine at no load speeds below about 650 engine r.p.m. Results of these tests (one run in each case) with "large" carbon are as follows:—

Engine r.p.m.	465	520	600
Percentage of large carbon passing	3·5	2·5	1·0

Further brief tests at these speeds with some load indicated that the proportion of large carbon passing the turbocharger decreases as the load increases.

The above table is extended as follows:—

Engine r.p.m.	465	520	600
Percentage of large carbon passing—			
at No Load	3·5	2·5	1·0
at 6½ h.p.	2·0	....	
at 16 h.p. . .	1·0		
at 21 h.p. .	....	0·6	

The tractor tested was bare of equipment; in any practical situation the cable control and other gear would impose a certain minimum load at any speed.

W. F. BAILLIE,
Testing Officer.

G. H. VASEY,
Officer in Charge
Tractor Testing.

University of Melbourne, 11th September, 1959.

1.—Waterlogging due to impeded drainage made this site quite impossible for fruit trees in its original state. The following pictures show how it was drained in preparation for planting

ORCHARD DRAINAGE

By R. G. CAHILL, Horticultural Instructor, Bridgetown

UNDERGROUND drainage of orchard land is an essential feature of fruitgrowing which is overlooked by many orchardists. Soils should be adequately drained to cope with all winter rains.

Even in years of sub-normal rainfall many orchards in the south-west of Western Australia suffer from adverse effects of water-logging with resultant root damage. Well drained soils allow better root development over a greater volume of soil, giving a larger root zone from which to draw moisture during summer.

The symptoms of water-logging can often be easily recognised. In other instances where it may not be directly obvious, only a slow decline of the trees will result. Bad drainage is often seen in the poor weed growth in orchards.

Apple trees may show delayed foliation in the spring and later yellow and sparse leaves lacking normal tree vigour. Such trees are first likely to appear in isolated patches on, or at the foot of, slopes which may appear well drained.

This is due to an uneven depth of heavy clay subsoil, or rock formation approaching nearer the surface at some points

than others. Water penetrating to this layer will move along its surface and collect in ponds behind the ridges.

To effect drainage, channels must be cut through these clay or rock bars. Results of this are clearly visible in the accompanying pictures. The presence and location of the bars is readily determined by forcing a probe made of a 5/16 in. steel rod into the ground at likely spots when the ground is wet.

2.—The cause of the trouble—hardpan at the bottom of the slope—was readily detected by the use of a steel probe

It must be made quite clear that drainage of the soil only removes excess water and does not take away water which would have provided summer moisture for tree growth. When rain falls on the ground it wets the soil to field capacity, after which further water will drain away in the drainage system. The remaining moisture is only removed by root absorption or evaporation. Bad drainage causes a depletion of oxygen in the soil with subsequent ill effects on root growth and hence on tree vigour.

There are a number of methods in use for draining orchards.

The use of jarrah saplings—two placed in the drain bottom with a third placed on top—has proved quite effective. There is little need to remove the bark and the sapling tops can be used to lay over the top of the saplings prior to filling with earth. The box type drain made from slabs of timber has also done good service in many orchards and endured for years.

But as drainage is something which only wants to be done once in the lifetime of an orchard, the best service will be obtained from the use of agricultural

3.—Drilling and blasting the rock bars was a preliminary to laying drains

4.—Cleaning the drain out to 3 ft. 9 in. deep before laying 4 in. terra cotta drainage tiles

pipes. Terra cotta pipes appear to be the best. Use of cement pipes should be approached with caution because soil often has a corrosive action on cement.

The pipes should be carefully placed in the dug drain leaving a 1/16 in. gap between pipes to allow water entry. Over each gap is placed a shovel full of coarse blue metal or washed gravel. This gives good water penetration while stopping clay or soil from clogging pipes.

In the Bridgetown and Boyup Brook districts poor drainage occurs mainly as odd patches in an orchard and a central drain through these parts drained to the most convenient point is usually sufficient. If the area to be drained is large, spur drains connecting with the main drain can be used.

When considering the number and depth of drains, the soil type and the area to be drained must be the governing factors. Where impermeable clay subsoil occurs close to the surface little lateral movement of water is obtained and close drains will be required. In some circumstances a drain every second row may be needed. In this type of soil the subsoil is usually within two feet of the surface and a drainage depth of 2 ft. 6 in. to 3 ft. is desirable. On lighter loam soils where side movement of water can be assured

5.--Drainage completed: Drains laid up and down the slope 84 ft. apart removed surplus water and the land is being prepared for planting. In heavier soil drains at more frequent intervals would probably be required

less drains would be needed to drain the area. In such soils the clay subsoil is usually deeper and drains could with advantage be dug to four feet.

If the orchardist cannot see his way clear to install underground drains in the first year of the young trees' life it is strongly advised that open drains either dug by hand or formed by a single furrow plough be used to drain off as much excess water as possible.

Too many weak sections both in old and young orchards can be traced to bad drainage. Remember that by rectifying this trouble early you will make your trees repay you early.

A FEW NOTES ON THE CENTRIFUGAL PUMP

By GEORGE GAUNTLETT, Assistant Officer in Charge, Irrigation

Pumps first appeared in Western countries about the beginning of the 17th century when a suction pump was installed on the River Seine to lift water for the citizens of Paris.

The modern centrifugal pumps are of quite recent origin. They began to be used for irrigation in Western Australia about 1905.

Practically all pumping for irrigation is now done with centrifugal pumps. The centrifugal pump is simple in design, easy to operate, maintenance is not unduly high and it has a long life.

Its working parts consist of a rapidly rotating impeller which imparts velocity to the water passing through it and the casing which guides the water from the impeller and serves to convert the velocity head into a pressure head.

The size of a pump as quoted by the manufacturer refers to the diameter of the delivery pipe. Thus a 4 in. pump is one with a 4 in. delivery. Where the pump size is shown as being 3-4 it means that the delivery is 3 in. and the suction is 4in.

Often the term "high lift" is used. This is not related to the suction lift but refers to the head against which the pump will operate.

Except where authorised by the manufacturers the suction lift should not exceed 15 ft.

The term suction lift means the height of the water surface level to the centre of the pump plus the friction losses incurred by the flow of water in the suction pipe.

In the installation of the pump the suction line should be as straight and as air tight as possible. Sharp bends should be avoided and no part of the line should be above the pump centre.

The efficiency of the pump varies chiefly with the quantity discharged, the head against which the pump works and the speed.

In the final testing of a well designed pump the designer draws characteristic curves in which the head, horse power and efficiency are plotted against the output at constant speed.

From the consideration of these curves the manufacturer is able to advise the correct size of pump, operating speed and horsepower required for any particular job. In order to ensure maximum efficiency irrigationists should adhere to these recommendations.

Operating a centrifugal pump with the discharge valve closed or partly closed does not result in a dangerous pressure being built up. However, if this is unduly prolonged overheating and subsequent damage to the pump may ensue.

Where a pump is delivering water against a high static head it is liable to damage in the event of a reversal of the direction of flow such as could be caused when the motor fails. In such cases it is advisable to fit a non return valve on the discharge side of the pump. This valve permits water to flow in one direction only and so prevents any tendency towards reversal of flow when the pump is stopped.

When trouble occurs it can be quite frequently traced to the suction side. Very briefly apart from mechanical defects the answer to troubles likely to occur are found in:—

(1) The suction line is not properly air tight nor filled completely with water.
(2) The suction lift is too high or the suction line is blocked.
(3) Speed of the pump is too low.
(4) Wrong direction of rotation.
(5) The discharge head is higher than intended.

—From an A.B.C. Radio Talk.

IT'S SHEARING TIME

SHEARING will soon be taking place on your property. For a smooth annual wool harvest, remember:—

1. Adequate prior preparation pays dividends.
2. Check overhead gear, down tubing, hand pieces, grinder, wool-press.
3. Order spare parts, combs and cutters, emery, bales, hooks, branding ink and brushes, spare guts, branding fluid, brooms.
4. Repair machinery.
5. Gauge hand pieces with the appropriate post gauge.
6. Give machinery a trial run—check R.P.M. Speed at friction wheel should be 600-640 R.P.M., according to manufacture; speed of grinder should be not less than 2,500 R.P.M.
7. Check shed.
8. Repair broken grating, wool table, wool bins, holding yards. Is your wool-rolling table large enough? It should be at least 10 ft. x 5 ft. in dimension.
9. Make sure gates of catching pens function smoothly.
10. Clean shearing board with disinfectant.
11. Is light adequate? More skylights may be needed or the existing ones may need cleaning.
12. Check counting-out pens and clean away weeds—make sure gates are secure.

The Sheep and Wool Section of the Department of Agriculture conducts shearing schools in country areas. If a school is required, early application should be made to the Officer in Charge, Sheep and Wool Section, Department of Agriculture, South Perth, or your nearest Agricultural Adviser.

MULESING AT LAMB MARKING TIME

By M. BUTLER, Sheep and Wool Instructor, Perth

REALISING that mulesing and tailstripping of sheep is the most effective system devised to counteract the loss and damage caused by blowfly strike in their sheep, many farmers and pastoralists are now incorporating it as standard practice in their system of sheep husbandry.

Experience over the years has proved its value as a means of reducing the susceptibility of sheep to blowfly strike, and if carried out correctly on the young sheep each year, it confers near positive and life long protection from crutch strike.

Woolgrowers are aware that blowfly activity is governed by seasonal conditions, and when these are favourable (particularly in those years when soft green feed is abundant), the blowfly becomes most active. They must keep a constant watch on the flock and treat any sheep that become struck.

Most strikes occur in the breech of sheep which, due to their conformation

remain wet in that area for long periods. The continued wetting of the wool in the breech sets up inflammation of the skin which gives off an odour attractive to blowflies. Such sheep quickly become struck and form the breeding ground for successive generations of blowflies.

Mulesing and tailstripping of sheep is designed to lessen the susceptibility of sheep to blowflies by enlarging the area of non woolbearing skin in the breech, which enables the sheep to remain dry and less susceptable.

Mulesing Lambs.

Although this treatment is best carried out on sheep at weaner age, quite a few growers mules and tailstrip their lambs in conjunction with marking, performing the whole routine of earmarking, mulesing, and tailstripping, castration and tailing at the same time, and in that order.

The practice of treating the lambs at marking time has the advantage that they are much smaller and easier to handle, and earlier protection from fly strike is gained, also the job is done without the necessity of further mustering the sheep.

Obviously, both marking or mulesing and tailstripping should never be carried out while blowflies are prevalent.

Some of the disadvantages of mulesing at marking time are that small lambs are relatively harder to do as they do not show development to the same extent as at weaning age and therefore require a thoroughly skilled operator to carry it out. Even then, a percentage may have to be retreated on reaching weaner age as it is not always possible to be 100 per cent. correct in treating lambs. In addition to the risk of mismothering, there is added risk of infection, as lambs have a tendency to lay about in the yards and contaminate the wounds while waiting for a drink from the mothers. Weaners being forced to fend for themselves will keep more on their feet and away from contamination.

One of the essential things to keep in mind at marking time is that to achieve maximum protection from blowflies, the tails must be cut to proper length, that is, *they must, when healed, be level with, or just lower than the tip of the vulva.* Current practice among many graziers is to cut the tails short, in some cases, they leave no tail at all. By doing this they are depriving the sheep of any chance to keep clean and thereby increase their susceptibility to fly strike.

All Merino sheep, whether fine wool or strong wool types, will benefit considerably by being mulesed and tailstripped. This is verified by many growers who have learned the technique and put it into practice on their own flocks.

At Wongan Hills Research Station, experimental sheep left unmulesed and not tailstripped last year suffered fly strike to the extent of 20 per cent. up to March this year (crutching time), while a corresponding flock of mulesed and tailstripped sheep depastured under similar conditions registered not one strike. Similar results were obtained on Merredin Research Station.

Labour Cost.

The labour cost of mulesing and tailstripping sheep is approximately £2 10s. a 100, and being permanent, needs only to be done once in the sheep's life. As the useful life of the sheep on the property is usually about five years, it works out at something in the vicinity of 10s. a 100 a year or just over one penny a sheep a year, surely a small price to pay for the high degree of protection it affords the flock from blowfly strike.

While mulesing and tailstripping is much easier to do when applied to freshly crutched weaners, fly strike in lambs may be a problem on the property and it may be desirable to treat them as lambs. This decision is one the individual owner must make for himself. Those who have not, as yet, adopted mulesing and tailstripping, would relieve their sheep of a lot of suffering and save themselves valuable time and money if they adopted it as routine practice.

Officers of the Department of Agriculture have been instructing growers for some years how to correctly mules and tailstrip their sheep and are available to give this instruction where required. Applications for instruction should be made to the local Agricultural Adviser or direct to the Sheep and Wool Section, Perth.

—from an A.B.C. Radio Talk.

ORGANIC MANURES
in Commercial Vegetable Growing

By T. WACHTEL, Adviser, Horticultural Division

AT one time organic manures provided the only means to return the plant nutrients into the soil, which were removed by cropping. With the rapid increase of mechanisation, these materials have become very scarce, and their cost extremely high. It is, therefore, necessary to consider whether the benefits gained from their use are sufficient to warrant their high purchase price, or indeed whether the use of manures is warranted at all.

For a long time it was believed that no satisfactory growth of plants could be expected without the use of organic manures, and that they contained certain essential compounds which could not be supplied in chemical fertilisers. Today we know that this is not the case. It is possible to grow plants fed entirely on chemical fertilisers, in fact it is even possible to grow plants without soil, in water cultures. Once we know that it is technically possible to grow vegetable crops without the use of organic manures, the question of whether or not to use them becomes a matter of comparison of costs and gains.

Organic manures serve a twofold purpose in vegetable growing. They can be looked upon as a source of plant nutrients, or as a source of organic matter, or humus, which has an important effect on the physical properties of soils.

AS A SOURCE OF PLANT NUTRIENTS

Concerning the value of manures as a source of plant nutrients, vegetable growers would not be justified in buying manures for the sake of nitrogen, phosphate and potash they contained, as these elements could be purchased more cheaply in chemical fertilisers. To give an indication of the money value of the major plant nutrients in, say, a ton of horse manure of average analysis, it may seem surprising that the same amount of nitrogen, phosphate and potash could

be purchased in chemical fertilisers for something like 25 shillings. In general, nitrogen is the most plentiful in manures and phosphorus the least abundant. The chemical composition of manures varies according to their source and handling, but even poultry manure, being the highest in plant nutrients, would be too expensive to buy solely for the sake of its nutrient content.

Related to this question is that of availability of plant nutrients. The values in analysis are not strictly comparable to the same amounts of nutrients supplied in chemical fertilisers owing to the differences in availability in the two forms of material. The nitrogen in manures is slowly available, and only about 25 to 50 per cent. of it becomes available to the crop the first year after application. The nitrogen in chemical fertilisers is more readily soluble and may easily be leached out of the root zone. Since the nitrogen in manure is slowly available and does not leach, it may sometimes be a major factor in producing higher yields on soils subject to leaching.

The rate of release of nitrogen from the manure depends on the soil temperature. The higher the temperature the faster the release, provided that there is sufficient moisture and air for decomposition to occur. Since the growth of vegetables is also related to soil temperature, the periods when the plants make rapid growth may coincide with the faster release of nitrogen from the manure. However, slow availability of nitrogen is not always desirable since many vegetables require large amounts of nitrogen over a short period of time. Also, the same gradual availability of nitrogen could be achieved by timing applications of nitrogen topdressings. Here again, comparative costs should determine which is the more profitable practice.

The speed of release of phosphorus and potash is roughly the same in manures as in chemical fertilisers.

ORGANIC MATTER CONTENT

The main benefit of manure in vegetable growing is in its organic matter content. But again we have to pay close attention to the costs involved and benefits gained. One of the most difficult problems facing the vegetable grower is to maintain the organic matter content of the soil. Usually the crop residues are not sufficient to replace the organic matter lost annually through cultivation and cropping. The loss of organic matter is due to the action of micro organisms which decompose it ultimately to carbon dioxide.

In light sandy soils the importance of organic matter lies in its capacity to increase the amount of nutrients the soil can hold in a form which resists leaching. It also increases the waterholding capacity of these soils, but does not have a great effect on the soil structure since these soils have a low clay content. In heavy soils with a high clay content organic matter has an important function in developing a good soil structure. Various compounds formed during decomposition cement clay particles together into aggregates which make the soil more permeable to water and improve the aeration of the soil. Organic matter has only a slight effect on the waterholding capacity of heavy soils.

It requires fairly large amounts of manure to replace the organic matter lost each year during cultivation. The amount may be as high as 10 to 20 tons per acre per year, depending upon the cropping system and the area. An important point to remember is that for each prevailing climatic condition and soil type there is a normal equilibrium level of organic matter which the soil can maintain in the long run. With soils that are well aerated and receive a high amount of moisture and temperature—like the sandy market garden soils around Perth—the organic matter decomposes very rapidly, and the normal organic matter content is naturally low.

It is very difficult, and very costly to attempt to increase the organic matter content of a soil above a normal level for the prevailing soil and climatic conditions.

USING ORGANIC MANURES

Here are a few practical hints for the use of organic manures:—

At present prices, organic manures would be too expensive to use for the sake of their nutrient content, but in many cases their use is justified as a means of increasing the organic matter of the soil.

Nutrients in organic manures are seldom in a desired balance, and must be supplemented with chemical fertilisers, especially phosphorus.

In some areas there is a possibility of using manure substitutes such as composts, sewage sludges, and other organic waste materials.

The rate of manure to be used is governed by the kind of crop, character and fertility of the soil, but above all, it is governed by economic considerations. Heavy applications cannot be justified on crops that bring a relatively low return. Where the supply is limited and the price high, light applications will usually bring the greatest net return. With most vegetable crops 10 to 15 tons of horse or other animal manures that contain similar percentage of nitrogen, supplemented with chemical fertilisers, will give greater money return than heavier applications of manure. The rate of application of poultry manure should be lower than that of any other kinds that contain less nitrogen. It is again emphasised that manure is not a balanced fertiliser. For this reason it is more economical to use a moderate quantity and to supplement it with chemicals.

The manure should be used on crops which give the greatest response or on crops of the highest value. With a limited supply it would be far better to use it on melons and similar crops, which give good responses, rather than on crops like sweet corn or dry beans which give relatively small responses.

Well rotted manure contains the nutrients in a more concentrated form, and the nitrogen is more available. It is also safer to use than fresh manure, as the latter may often cause ammonia burn to young plants.

Fresh manure, or manure which contains a large proportion of straw, sawdust, or other undecomposed material of high carbon content, may lead to a temporary nitrogen starvation of the crop, as most of the available nitrogen is being used up by micro organisms engaged in breaking down the organic matter. However, on newly ploughed swamp soil a single application of a small quantity of fresh manure might have the benefit of supplying the necessary bacterial population for the breakdown of the high amount of organic matter present. The bacteria would also use the excess nitrate, and thus prevent its toxic accumulation.

The most common method of application of organic manures is to broadcast them before ploughing in. Ploughing in is essential where fresh manure is used. Rotted manure may be broadcast and harrowed in lightly. With short supplies application in furrows—especially for melons, cucumbers and similar crops—is the most economical method, even if this involves more labour. With horse manure applied in furrows, the heating effect may hasten germination and early growth.

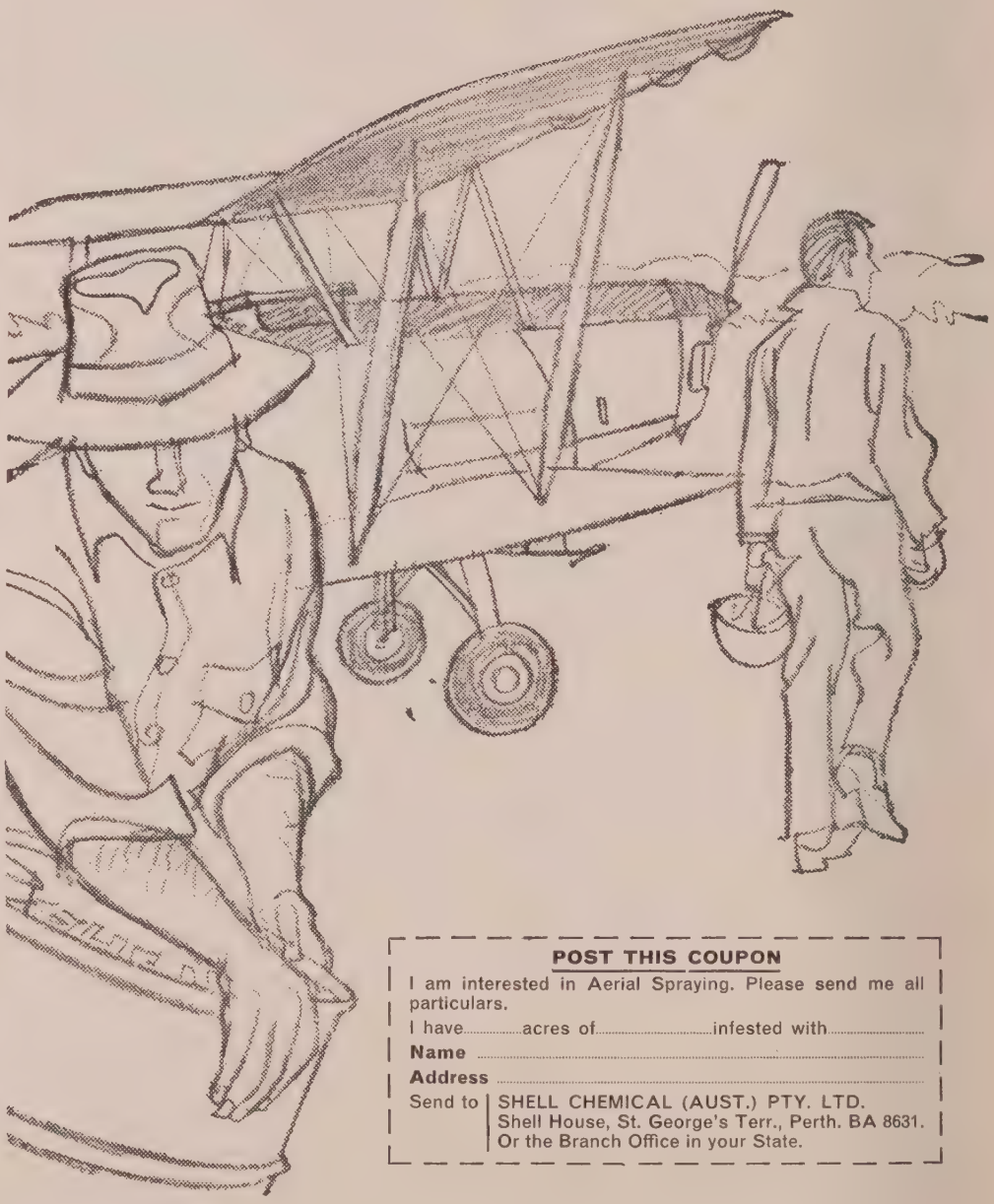
NATURALISED GARDEN PLANTS CAN BE DANGEROUS

By R. D. ROYCE, Officer in Charge, Botanical Branch

A POISONOUS plant is only dangerous in so far as human beings or animals come in contact with it, or ingest it. Even the most toxic plant growing in the protection of a garden is unlikely to cause trouble.

However, every poisonous plant cultivated in gardens, particularly in country districts, is a potential menace to the pastoral industry. From past experience it can be stated quite definitely that the more popular they become, the greater the risk. It is inevitable that sooner or later the garden refuse dumped in the open paddock or, as so often occurs, along the roadside, will contain viable seeds, bulbs or corms of species which are capable of developing in competition with the native flora and other weeds. Seeds may also be blown by the wind or distributed by some other means into areas outside the garden where they can germinate, develop and spread. And so new weed species become established.

This is how the Prickly Pear and Lantana became naturalised in Queensland and New South Wales and how Patersons Curse, Arum Lilly and Cape Tulip became established in this State. It is bad enough



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if the newly established garden escapee proves to be a vigorous and aggressive weed, but if it is a toxic species, such as Lantana or Cape Tulip, it is of much greater economic significance, and its establishment may well be the forerunner of the deaths of hundreds of head of stock. The garden lover should therefore be very careful in disposing of garden refuse, particularly if recognised toxic species are amongst the plants being grown.

Various species of bulbs, as well as Iceland Poppy, Chili and Primula have been mentioned in previous talks, and if any of these became widely naturalised they could cause serious trouble amongst stock. Delphiniums and Larkspurs too, are highly toxic and annually cause losses in America where they are native plants. Foxgloves, Eschscholtzia and Ranunculus are free seeding plants which are known to contain a poisonous principle, and if any of these manage to become established as garden escapees, they would undoubtedly in a few years become widely naturalised plants of a most undesirable character.

Many species of Asclepias, usually referred to as Cotton Bushes are popular garden plants. They have unusual though attractive flowers, feathery seeds, and a white milky sap. Queen Anne's Lace or Lace Plant is a popular plant in gardens at the present time, and its white masses of flowers are undoubtedly attractive. However, it produces an abundance of seeds and in N.S.W. where it is widely naturalised it is known as Bishop's Weed. All of these plants, together with such old favourites as Salvia, Lobelia and Zinnia, are very decorative in the garden, but should be kept there, since if allowed to become naturalised, nearly all of them would be capable of causing stock losses.

Although Hemlock has long been regarded as a bad weed and toxic plant, it is still grown to a certain extent in gardens. Actually it is naturalised in this State already, and it was this plant which was used as flails or whips by some Albany schoolboys a few years ago in a game which resulted in serious illness from allergic reactions to the plant sap. It is known that foliage of the related parsnip is capable of causing dermatitis in a similar manner.

All of these plants depend mostly on seeds for their spread and persistence, but it is the perennial garden plants which are a much more serious menace. Succulent plants such as Cotyledon, Sedum, Cactus, Euphorbia and particularly Kalanchoe, the Tree of Life, are capable of remaining alive on a rubbish heap for months during the summer time and then developing roots during winter. Even single leaves and small fragments of stem are capable of rooting and continuing growth. Deep rooted plants are also of particular significance. The Potato Creeper or Madeira Vine is a vigorous plant which develops an extensive rooting system, and if it once became established as a weed it would be extremely difficult to eradicate. Similarly Four O'Clock produces large carrot-like root structures which would give it a great advantage as a weed, while the Woodsorrels and Vinca develop underground structures by means of which the plants can spread vigorously and rapidly.

Many of these perennial species are known to be toxic and when garden beds are being thinned out or the plants cut back, it is important that the plant refuse should be burned or otherwise destroyed and not scattered about on unofficial rubbish heaps.

Planting Fruit Trees

By K. T. Whitely, Horticultural Adviser

OVER the next few months many fruit growers will be busily engaged in the task of planting fruit trees. Many mistakes can be made in this apparently simple task, and to avoid these it pays to follow a few simple rules in planting procedure.

The best time to plant depends on the type of tree concerned. In general, deciduous fruit trees should be planted in June-July and citrus in August-September when the main risk of frost is over.

On arrival from the nursery the trees should be thoroughly examined. As a result of measures taken in the nursery they should be free of pests and diseases but a careful examination is still warranted and can be a practical safeguard against later troubles in your young orchard. A careful inspection should be made for crown gall, scale and woolly aphis. Anything doubtful should be set aside for examination by your local horticultural instructor.

Should the trees arrive before you are ready to plant it will be necessary to "heel them in" by digging a trench deep enough to take the root system, filling moist soil in around the roots and watering, preferably in a shady spot. With citrus however, heeling in is to be avoided if possible due to the extra handling, exposure and damage to the roots and in their case watering of the packing material will be sufficient if they are only to be held for a couple of days.

The weather at transplanting time is important. Trees should never be transplanted on days which are unusually warm or while any drying winds prevail. Cool or showery weather gives best results though even on such days ample care must be taken in covering of roots with wet bagging to prevent drying out while awaiting planting.

If possible holes should be dug just in advance of planting; they should be large enough to accommodate the root system easily and a 2 ft. diameter hole a foot or so deep will be adequate for most trees. The amount of fertiliser placed in the hole at planting should not be overdone and 2 or 3 lb. of mixed fertiliser such as potato manure is ample.

If desired a shovelful of well rotted compost or animal manure may be added. The mixture should be worked into the bottom of the hole and covered with a good layer of fresh soil to prevent direct contact with roots. Fresh manure or any appreciable quantity of chemical fertiliser is apt to cause injury to root growth.

To get proper alignment of the trees it is advisable to use a planting board. This is a simple yet effective means of ensuring that the tree is in exactly the same position as the marker peg and also acts as a guide to the correct level to set the tree in the soil.

The selected tree should have its roots trimmed with secateurs to remove any diseased or broken rootlets, but the root system should not be reduced more than is necessary before planting.

Planting Depth.

It is usual to plant the tree at approximately the same depth as it was in the nursery, due allowance being made for the settling of the soil, and as this "ground" line is usually visible on the trunk, it acts as a good guide for planting depth. *Having the bud union above the soil level is particularly important for citrus as the scion varieties are much more susceptible to phytophthora root rot than the rootstock.*

A good spreading of the roots is achieved at planting if a cone of soil is formed up in the bottom of the hole and the lower roots spread over this cone. Fine soil is then worked in with the hands until the hole is partly filled. The tree is then moved gently up and down to allow the soil to sift into the root system and the remainder of the hole filled and tramped, leaving a shallow basin which is immediately filled with water.

In windy localities, the tree should be arranged so that the strongest lowest limb is in the direction of the prevaling wind, trying as far as is possible to have the scar left by the removal of the stock at the bud union on the south to south-east side, that is, the shady side of the trunk.

In order to restore the balance between the shortened roots and the tops the latter should be cut back to about 18 in. above the ground. This may mean the complete removal of all branches or the selection of the three best shoots below 18 in. and shortening them back to approximately 6 in. All other growths should be completely removed.

With citrus it is also necessary to drastically reduce the leaf area of the

tree. This can be done by cutting the leaves on the remainder of the tree in halves, crossways.

Especially in more exposed localities it may be necessary to tie the tree to a stake to keep it upright in growth and reduce wind damage. If possible a "guard" of newspaper, strawboard or hessian should be tied around the tree to deter rabbits and to prevent sunburn.

Every effort should be made to maintain the growth achieved by this careful planting by proper husbandry through the growing season. In short, having planted the tree carefully, grow it properly.

REARING ORPHAN LAMBS

By Dr. L. C. SNOOK, Animal Nutrition Officer

ORPHAN LAMBS are easy to rear if a few basic principles are understood.

The milk of the ewe is quite rich, containing about twice as much butterfat as is present in ordinary cow's milk. It follows that cow's milk should never be diluted with water if it is to be fed to lambs. In fact, the aim should be to obtain milk which is as rich as possible. If fresh cow's milk is not available, reconstituted dried milk can be used with every confidence. Do not add sugar to the milk fed to lambs.

Under natural conditions, the young lamb has small drinks at frequent intervals. Obviously, there is a limit to the number of feeds which can be given to an orphan lamb, but, if possible, feed it five or six times daily during the first week. A cup full of milk given at each of these feeds should be adequate for the young lamb. As it grows, the lamb will drink more, and the number of feeds can be reduced.

Overfeeding is a serious fault. In most cases a lamb will stop drinking when it has had enough and no attempt should be made to encourage it to drink more. Lambs which are fed only two or three times daily become quite hungry and tend to drink too much too quickly. Such overfeeding can produce stomach upsets, but even so many lambs are reared successfully on twice-a-day feeding.

A small clear-glass tomato sauce bottle is very convenient for feeding young lambs. A cup full of milk will just about half fill such a bottle. An ordinary rubber teat from a baby's bottle completes requirements.

Cow's milk can be expensive. Fortunately there are a number of substitutes which can be used easily and which will cost less. My young daughter now has a robust young lamb which was reared for several days on fresh cow's milk. For the next week it was given only one feed daily of the rich creamy milk from the top of the bottle. Reconstituted dried skim milk was used for the other feeds. Now the lamb receives only the skim milk. This is made by mixing two heaped up tablespoonfuls of dried skim milk powder in a pint of warm water. Dried buttermilk powder is equally good.

Lambs start to eat at an early age. Rather surprisingly, they seem to prefer hay to fresh green grass. Young tender green grass is also attractive. Lambs should be given every encouragement to eat natural feed.

Fresh clean water is another essential. Lambs soon learn to drink water, particularly where green feed is unavailable.

Where hay and green grass is unavailable, a mixture of crushed cereal grains and linseed meal should be prepared to encourage the lamb to eat solid food. Just what is put into this feed mixture will vary according to circumstances but so long as the lamb eats well, this is the main thing.

There is no need to feed milk to an orphan lamb after it is three months of age. In fact, if the lamb has been taught to eat good quality solid food it can be weaned even younger. As soon as the lambs drink a reasonable amount of water, for example, they can be given dried skim milk or dried butter milk in a meal mixture, rather than through a bottle.

Cleanliness, of course, is essential. Milk which is not consumed should be discarded and not kept and returned to the bulk supply. After the first week, it is not necessary to warm milk to blood heat. Naturally, a young lamb should not be given milk direct from the refrigerator but no harm will result from the use of milk at ordinary temperatures.